



A systems perspective on AI adoption in Life Sciences

Why Pharma Organisations Need Systems Thinking to Scale AI

This paper explains why, what it costs, and how leaders can move from pilot success to portfolio-level economic impact within 12-18 months.

- + Fewer than one in ten is realising enterprise value.
- + Technology is no longer the limiting factor.
- + Organisations must consider how to wire around it.

\$60-110bn

Annual value at stake

forecast economic value of generative AI across the pharma value chain, per year

McKinsey, 2024-25

3.4-5.4pp

EBITDA upside

projected EBITDA expansion for pharma adopters of agentic AI over 3-5 years

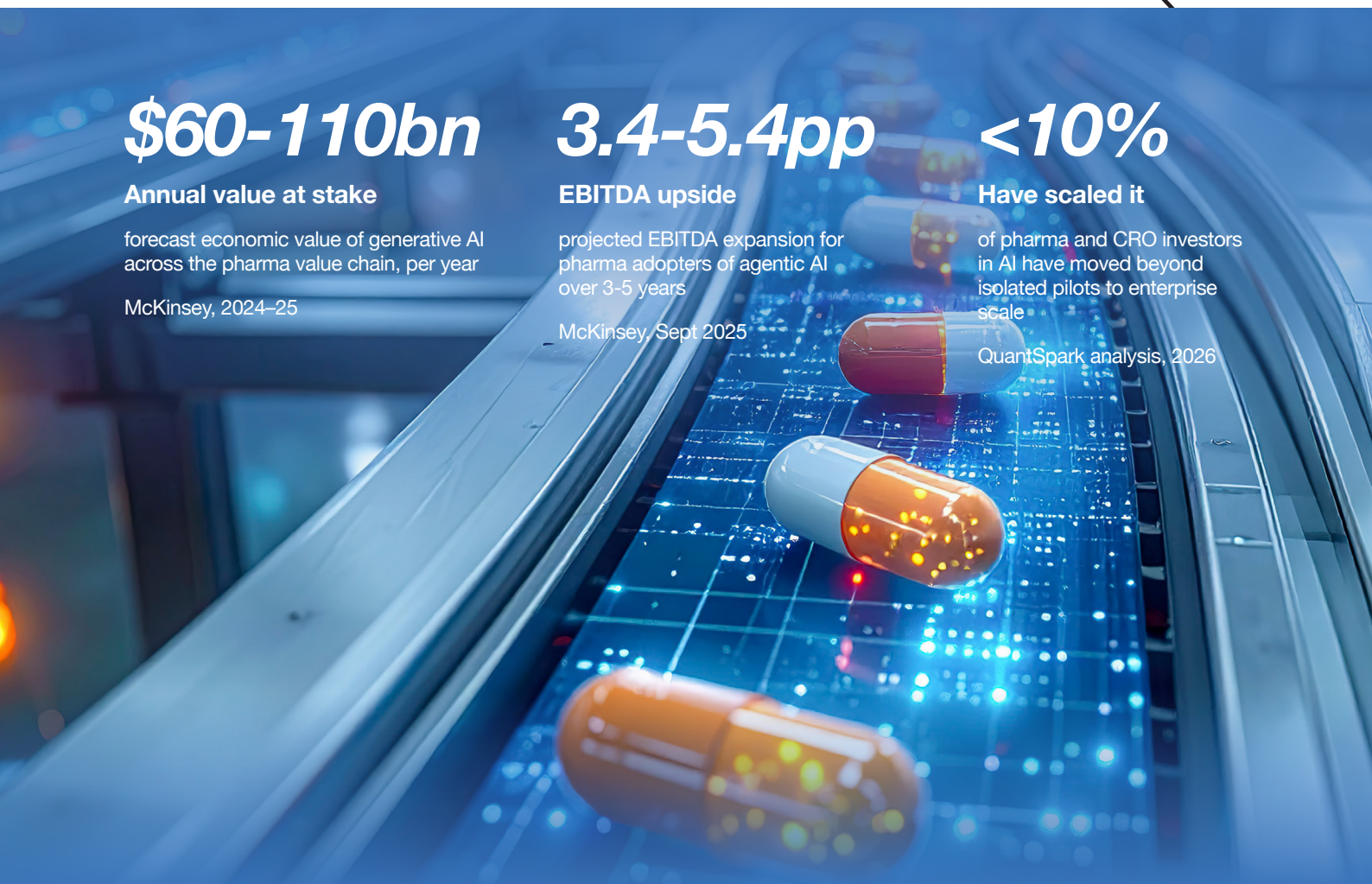
McKinsey, Sept 2025

<10%

Have scaled it

of pharma and CRO investors in AI have moved beyond isolated pilots to enterprise scale

QuantSpark analysis, 2026



Contents

I. The AI Illusion: Investment Without Impact

Pharma is spending billions on AI but half the biggest companies still can't prove it's paying off.

II. Organisations Behave Like Biological Systems

Just as modern medicine sees the body as interconnected systems, pharma organisations are too, yet they still deploy AI in isolated silos.

III. The Mistake: Linear Thinking in a Nonlinear System

86% of trials run late because problems pile up across the whole system, fixing one piece with AI isn't enough.

IV. Where Value Actually Sits: Leverage Points

Most companies adopt AI in simple steps, find a problem, add a tool, measure results: but clinical development is too complex for that approach.

V. A Systems Approach to Identifying AI Opportunities

A better AI model for pharma has three phases: Discover, Prototype, Scale.

VI. Case Insight: CRO Deal Origination

A CRO fixed slow deal origination not by adding AI alone, but by connecting fragmented data and redesigning how teams prioritise leads.

VII. The Strategic Choice: Optimisation vs Transformation

Every pharma org will adopt AI, the real choice is whether to optimise old ways or build new ones, and the cost difference is massive.

VIII. Systems maturity curve

AI adoption is inevitable, what matters is whether organisations use it to patch old systems or redesign new ones, and the financial gap between those paths is clear.

IX. Implications For Leadership

AI transformation is an operating model shift.

Conclusion

Executive Summary

The case in



AI in pharma and CROs is failing because organisations treat it as a tool to deploy rather than a system to redesign, and the financial cost of that choice is measurable.

The Economic Gap

Across life sciences, AI is deployed into isolated functions, layered onto existing workflows, and measured locally. The outcome is predictable: pilots succeed, value does not scale, and return on investment remains unclear to the board. McKinsey's 2025 analysis estimates that 75-85% of pharma workflows can be enhanced or automated by AI agents, yet 42% of current AI initiatives in the sector fail to meet ROI expectations.

35-45%

Productivity gains achievable across clinical development functions

McKinsey, Sept 2025

12 months

Reduction in trial duration possible with agentic AI deployed at system level

McKinsey, Dec 2025

42%

Of current pharma AI initiatives fail to hit ROI targets, almost always for non-technical reasons

Industry analysis, 2026

The Thesis

Organisations that achieve material impact take a different approach. They treat AI as a **system intervention**, not a tool deployment. They redesign information flows, decision rights, incentives and workflows across the enterprise, measuring impact at the level of the asset, the trial, and the portfolio, not the pilot.

This paper draws on systems-biology analogies, peer-reviewed research from McKinsey, Nature Medicine, the FDA CTTI, JAMA Network Open, and Donella Meadows' leverage-points framework, alongside QuantSpark's operational experience inside pharmaceutical and CRO organisations. It sets out a practical, systems-led approach to identifying and scaling high-value AI opportunities, with the commercial detail required for board-level decisions.

THE CASE FOR ACTION

The audience is simple: every CEO, CFO, Chief Medical Officer, Head of Clinical Operations, Chief Digital Officer and Board member in pharma, biotech, and clinical research who has discussed AI strategy without yet redesigning the system around it.

Section I

The AI Illusion: Investment Without Impact

Pharma is not struggling to adopt AI; however, it is struggling to extract value from it. The pharma AI market is forecast to grow from roughly \$4bn in 2025 to \$25.7bn by 2030 (McKinsey, 2025). Yet only 40-50% of the top 20 pharma firms that have invested heavily in modernised clinical IT can yet point to a clear ROI.

95%
of pharma companies
are investing in AI

McKinsey Global Institute, 2025

40-50%

of top 20 pharma firms have not yet realised
clear ROI from clinical IT modernisation

McKinsey, Feb 2025

\$8.5bn

forecast AI-in-clinical-trials market by 2030

Informa Pharma Intelligence

- + AI capability is advancing.
- + Investment is increasing.
- + Enterprise outcomes are not following.
- + This is not a technology failure; AI is simply being applied at the wrong level of the system.

Section II

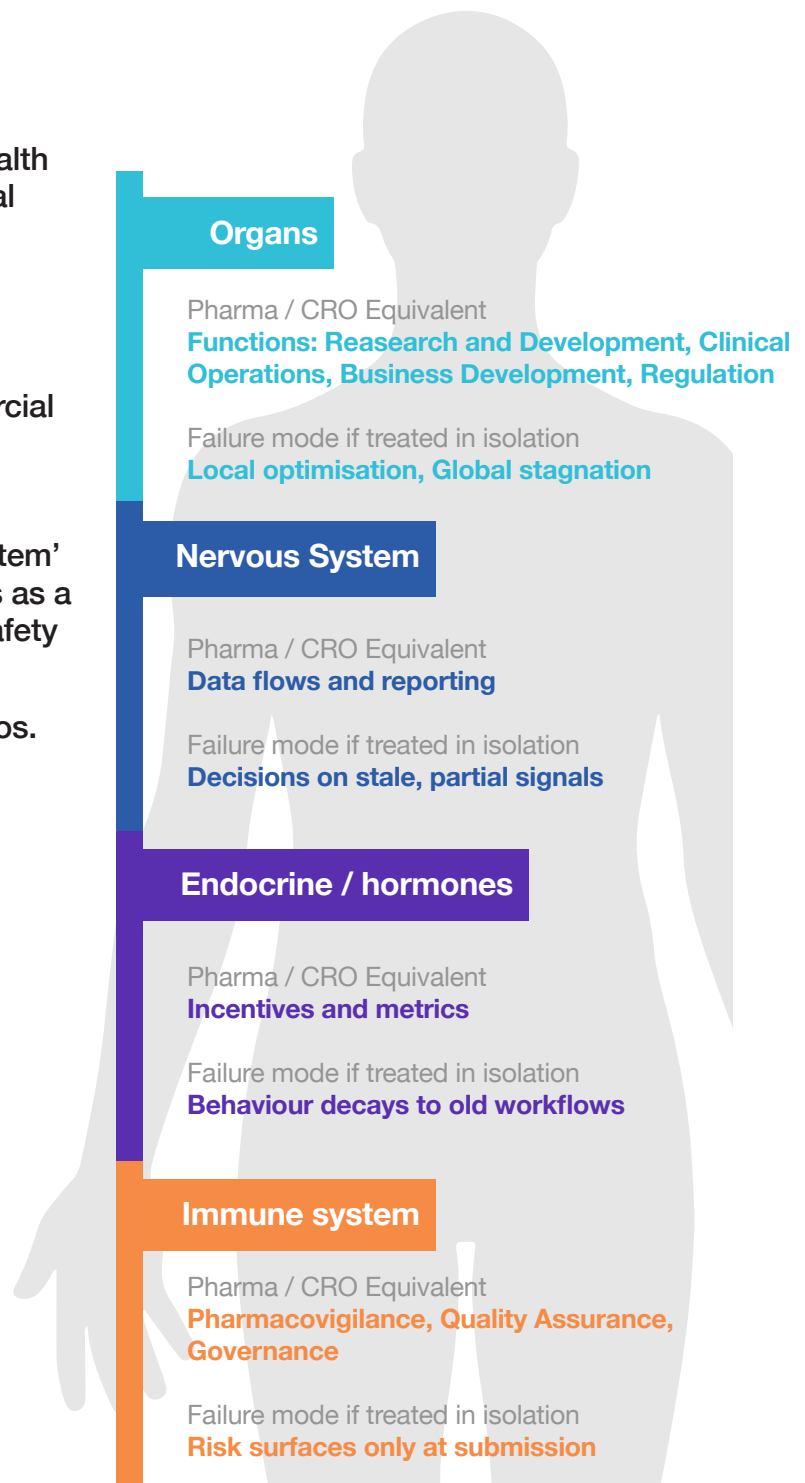
Organisations Behave Like Biological Systems

Modern medicine no longer treats the body as a set of isolated organs. Outcomes emerge from interactions between systems: cardiovascular health is linked to inflammation, neurological conditions to immune response, gut microbiota to mental health (Nature Medicine, 2025). Pharma and CRO organisations are no different.

Clinical operations influence commercial outcomes. BD depends on delivery. Regulatory timelines are shaped upstream by data quality. A failure in pharmacovigilance, the 'immune system' of the enterprise, eventually presents as a delayed launch, not as an isolated safety incident.

Despite this, AI is still deployed in silos.

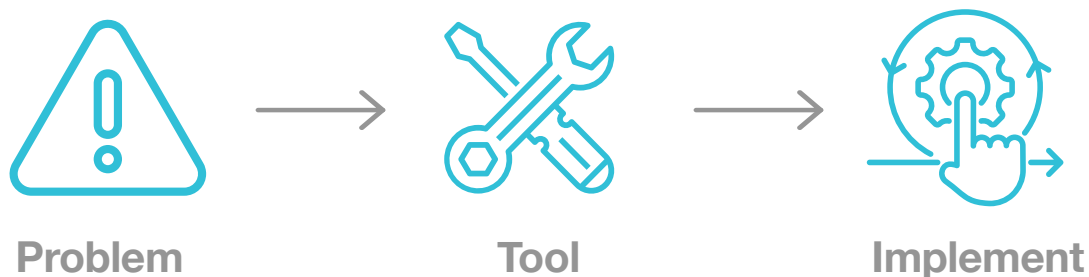
- + Treating one symptom rarely cures the disease.
- + Deploying one AI tool rarely transforms the organisation.
- + The organisation, like the body, is the unit of intervention.



Section III

The Mistake: Linear Thinking in a Nonlinear System

The dominant approach to AI adoption is linear: identify a problem, select a tool, implement it, measure output. This works in stable, bounded environments. Clinical development is none of those things.



This linear approach works only in stable, bounded processes.

Consider clinical trial recruitment delays, the single largest driver of trial cost overrun. **86% of trials miss their enrolment timelines** (industry benchmark, 2025).

A linear response focuses on immediate causes such as site activation or investigator engagement.

A systems view considers the full network of drivers: data latency across sites, protocol design complexity, patient identification pathways, sponsor and CRO incentives, and regulatory constraints (FDA / CTTI Workshop, 2025). The intervention points, and therefore the outcomes, are fundamentally different.

+ AI does not create value at the point of deployment.

+ Value compounds as workflows, decisions, and data are able to align around it.

Section IV

Where Value Actually Sits: Leverage Points

Low-leverage ai investment

- Automating reports
- Accelerating isolated workflows
- Reducing manual effort within existing processes

Generates incremental improvements. Does not change system outcomes, or board-level metrics.

High-leverage ai investment

- Redesigning information flows
- Changing decision-making rules
- Aligning incentives across functions
- Redefining goals and operating models

Source: Meadows, 1999; McKinsey, 2025. The technology is often the same. The impact is not.

THE COST OF STANDING STILL

**\$708m-
\$1.31bn**

median-mean R&D cost
per approved drug.

JAMA, 2025

~90%

of trial candidates
fail. Per-patient cost
\$113k-\$136k.

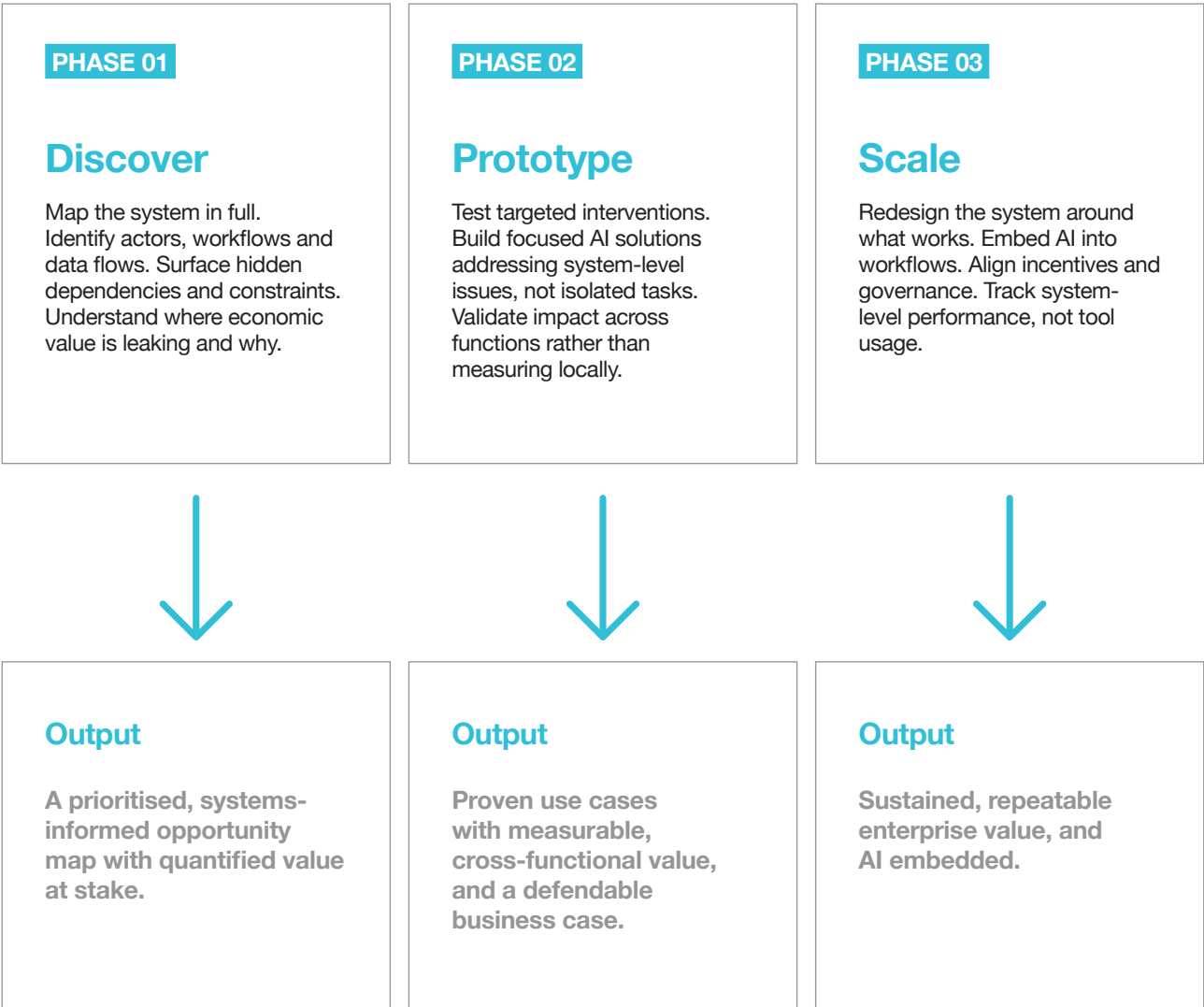
10%

improvement in trial
design or cycle time
= tens of millions per
programme.

Section V

A Systems Approach to Identifying AI Opportunities

A practical, evidence-based model for AI adoption in pharma and CROs comprises three connected phases: Discover, Prototype, Scale. Each is designed to expose system-level value rather than function-level efficiency.



Section VI

Case Insight: CRO Deal Origination

Surface problem

A clinical research organisation faced slow and inconsistent deal origination, characterised by manual research and fragmented BD workflows.

Underlying issue

Disconnected clinical capability data, historical performance, and external opportunity signals. Information existed; it was not flowing to the people making prioritisation decisions.

Systems intervention

Integration of internal and external datasets

- AI-enabled lead scoring
- Redesign of lead prioritisation logic
- Alignment of incentives across BD and clinical teams

Outcomes (within 12 months)



+ The value did not come from the model.

+ It came from redesigning the system around the model, data flows, incentives, and decision rules.

Section VII

The Strategic Choice: Optimisation vs Transformation

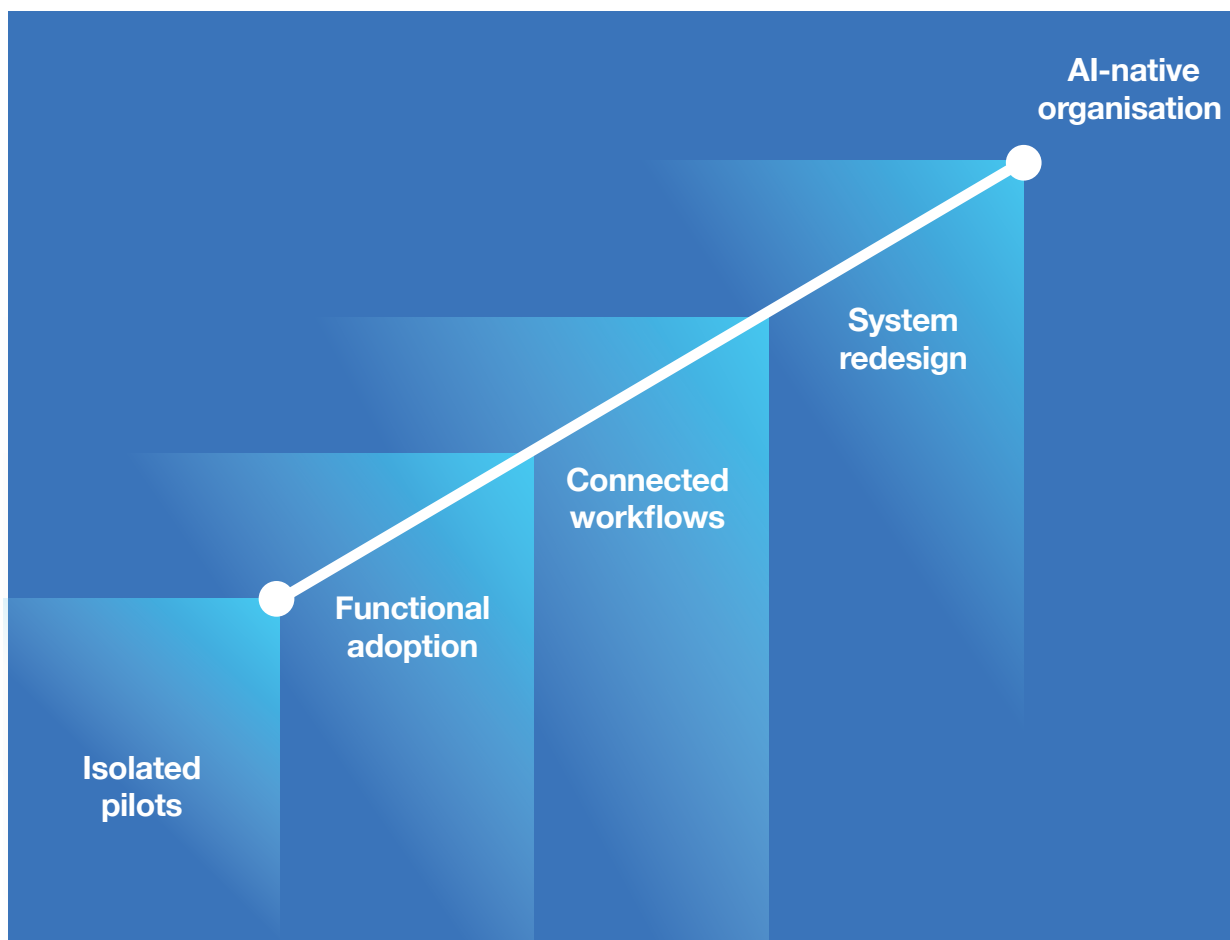
AI adoption is guaranteed. The choice organisations now have is whether AI is used to optimise yesterday's operating model or to build tomorrows. The economic gap between the two is both significant and quantifiable.

	Optimisation (the assumed solution)	Transformation (the actual solution)
Mindset	Faster reporting, lower cost, incremental efficiency	Predictive decision-making, integrated workflows, new operating model
Investment shape	Tool licences, function-by-function rollout	Data, process, people, and governance redesigned together
Typical KPI	Hours saved, tool usage, pilot completion	Trial duration, cost-per-patient, EBITDA margin, time-to-IND, time-to-launch
Reported impact	5-15% function-level efficiency	35-45% productivity gain across clinical development; up to 12 months off trial duration; 3.4-5.4pp EBITDA expansion McKinsey, 2025
Where it ends	Strong pilots, weak portfolio impact, board scepticism	AI embedded in operating DNA, competing on a different basis

Section VIII

Systems maturity curve

AI adoption is guaranteed. The choice organisations now have is whether AI is used to optimise yesterday's operating model or to build tomorrows. The economic gap between the two is both significant and quantifiable.



Maturity & Value

Level 1

Small-scale, localised experimentation.

Level 2

Technology deployment within specific business functions.

Level 3

Integration of data and processes across different teams.

Level 4

Overhauling and rebuilding core infrastructure specifically for AI capabilities.

Level 5

Full ecosystem integration where AI drives the business strategy and identity.

Most organisations operate at Levels 1-2. Material, board-visible value emerges at Level 3, while the leaders of the next decade are already moving deliberately to Level 4.

Section IX

Implications For Leadership

AI transformation is not a technology programme. It is an operating model shift. The pharma and CRO leaders who succeed in the next 12–24 months will be those who:

PRINCIPLE 01

Move from a parts view to a system view

Diagnose where value is lost across the whole enterprise, not within functions. The slowest step in the workflow defines the speed of the asset.

PRINCIPLE 02

Invest in data, process, and people. Not just technology

Licences without redesign produce optimisation, not transformation. The 42% of pharma AI initiatives that miss ROI almost always do so for non-technical reasons.

PRINCIPLE 03

Redesign workflows, do not automate tasks

A workflow is only as fast as its slowest step. Automating one step in a sequential process rarely changes cycle time.

PRINCIPLE 04

Align incentives to drive adoption

An AI capability without behavioural alignment decays. If the metric is unchanged, the behaviour will be unchanged and the value will not land.

The one action to take this quarter

Book a 90-minute Systems Diagnostic with us.

One session. Your senior team.

We map where your organisation sits on the maturity curve, identify the three highest-leverage AI interventions in your operating model, and quantify the economic value at stake before you commit another pound of AI budget.

No deck. No pitch.

A working session that leaves you with a defensible, board-ready view.

Request your diagnostic

Visit quantspark.ai

Email contact@quantspark.com

Conclusion

AI is not scarce

Tools are no longer the differentiator.

The differentiator is how an organisation is structured to extract value from AI. The evidence from pharma and CRO operations is consistent with what systems biology has taught medicine: outcomes emerge from the interaction of parts, not from the parts themselves.

Organisations that deploy AI into silos will continue to report pilot success and enterprise failure. The question facing every pharma and CRO leader is whether to build a system, or a collection of tools.

**See the whole. Strengthen every part. Augment intelligently.
Create lasting value.**



Selected sources

McKinsey & Company — Reimagining life science enterprises with agentic AI (Sept 2025); Agentic AI: Unlocking peak performance in biopharma development (Dec 2025); Faster, smarter trials: Modernising biopharma's R&D IT applications (Feb 2025); Generative AI in the pharmaceutical industry (2024). JAMA Network Open — Costs of Drug Development (Jan 2025). FDA / Clinical Trials Transformation Initiative workshop materials, 2025. Donella H. Meadows, Leverage Points: Places to Intervene in a System (1999). Nature Medicine & NIH Systems Biology references, 2025. QuantSpark internal analysis, 2025–26.

Authors



Adam Hadley CBE

CEO & Founder

adam.hadley@quantspark.com



Wanda Haddock

Head of AI Transformation

wanda.haddock@quantspark.com

Contact

www.quantspark.ai

contact@quantspark.com

230 Blackfriars Road
London
SE1 8NW