

Machine-Managed Enterprises

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Beyond Automation: Building the Fully Machine-Managed Value Chain

In previous posts, I explored two themes: first, that machines are now competently handling work once reserved for people - what we called the cognitive crossover - and second, that their capabilities are on a steep upward curve as AI learns without us.

That trajectory makes it rational for any organisation to expand the role of machines, if only to free human talent for higher-value work.

Consider a single workflow. Specific steps might remain strictly human—for example, approving that a regulatory requirement has been met as part of a governance process. Others are already machine-exclusive, like dispatching a routine confirmation email. Many tasks fall somewhere in between: some are easy for algorithms but difficult for people, and vice versa.

Consequently, each workflow displays a spectrum of human-versus-machine responsibility. Near the point where AI and human performance are roughly equal, either side can execute the task adequately, but with different types of resource trade-offs; this is the delegation zone. Predicting exactly where that zone lies is challenging because AI competence rises and falls unevenly along what researchers have called the jagged frontier. Performance isn't a simple yes-or-no—it varies within acceptable error bands— and it's a space where algorithms are excellent at some tasks and baffled by adjacent ones, see Figure 1.

Working across that shifting boundary is hard. Large-language-model agents cannot yet take over every task end-to-end, so companies must actively manage the hand-offs between human expertise and machine assistance.

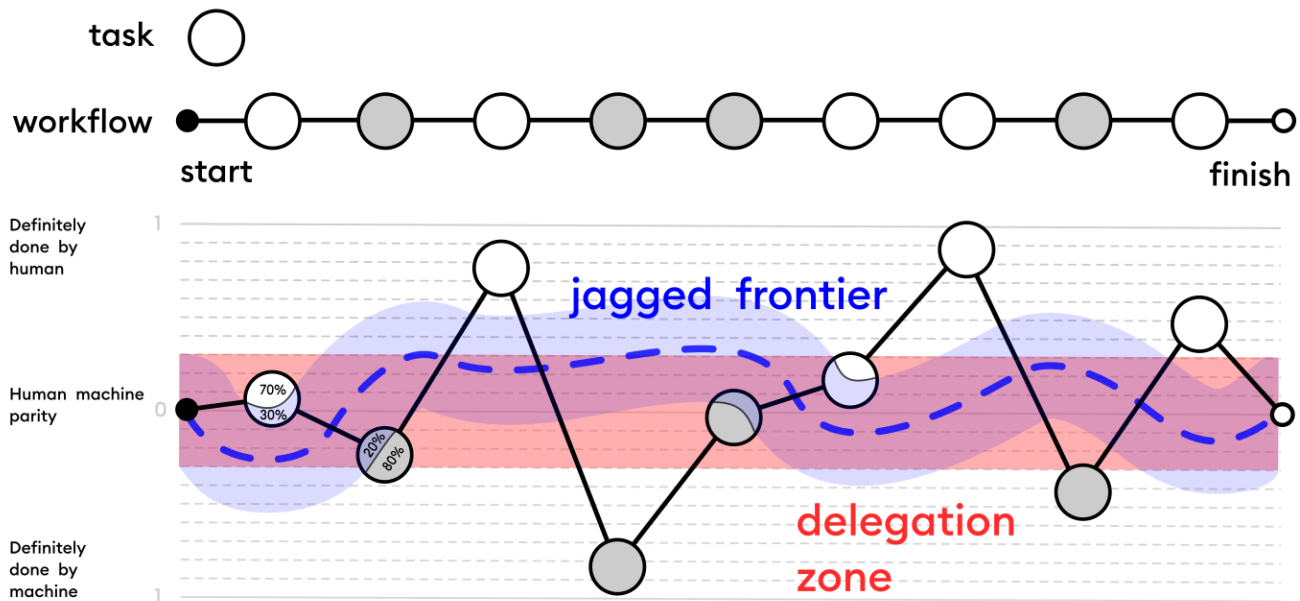


Figure 1 — The Jagged Frontier and Delegation Zone. The chart plots each task in an end-to-end workflow (horizontal axis) against how well humans versus machines can execute it (vertical axis). White nodes sit above the parity line—tasks still best handled by people; grey nodes fall below—tasks where machines already excel. The dashed blue curve traces the **jagged frontier**, highlighting how capability varies unevenly from task to task. The shaded red band marks the **delegation zone**: an overlap where performance is close enough that work can be reassigned dynamically between human and machine, depending on cost, risk, and required precision.

Automation frontier

By auditing every task in a firm’s value chain—each data hand-off, decision gate, or physical action—and scoring how well today’s technology could execute it, you can create a chart that orders workflows from “mostly human” to “mostly automatable”. Functions such as invoice reconciliation or route optimisation usually cluster on the right, while judgment-heavy or regulation-laden steps sit on the left. The vertical line that separates machine-ready flows from human-held ones becomes your automation frontier, see Figure 2.

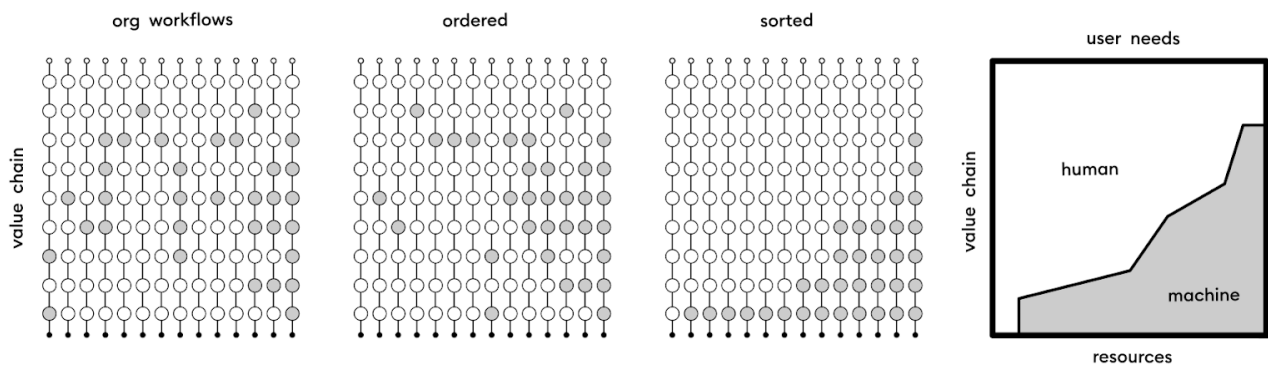


Figure 2 — Workflow Automation. The first three squares represent an organisation’s value-chain workflows. Grey nodes mark activities machines can already perform; white nodes remain human-run. **Org workflows** shows today’s mixed, unsorted state. **Ordered** re-aligns tasks within each workflow so that machine-ready steps cluster. **Sorted** then ranks entire workflows by their share of automatable tasks, creating a left-to-right gradient of increasing machine potential. The summary chart on the right converts that ordering into a cumulative “resource stack”: the shaded lower portion indicates capacity that could migrate to machines, while the upper contour identifies work that still relies on human expertise to meet user needs.

Machine-Managed Enterprise

Across any modern value chain—product development, sourcing, logistics, sales, and after-service—work involves hundreds of cognitive tasks: analysing data, planning inventory, evaluating trade-offs, managing exceptions, and making strategic and routine decisions.

Consultancy benchmarks suggest that, taken in aggregate, roughly half of all work activities could already be automated with technology that exists today—and that share is rising rapidly as generative AI matures.

Because machines are advancing fastest in data aggregation, pattern recognition and optimisation, they are beginning to shoulder not just the doing but the managing of work. A visible case is Uber, whose software dispatches drivers, sets dynamic prices, and enforces platform rules—functions once handled by fleets of human controllers. In transport infrastructure, London’s Docklands Light Railway has carried passengers safely since 1987 under fully automated train control, demonstrating that society accepts automation when the economics and safety record are compelling. These examples demonstrate that machine-led coordination is already operational at the metropolitan scale; with the advances in language-based AI, the question is how far it will extend within the enterprise.

One way to think about the journey is to view the organisation in strata. At the base layer lie tasks that machines can mostly already execute end-to-end. Above that sits a widening band of operational decision-making—routing trucks, scheduling staff, repricing inventory—where algorithms now rival or exceed human speed and accuracy. Satalia.com, a company I co-founded, saved Tesco 11.2 million miles in 2019, or 8% less fuel per delivery, by optimising vehicle routing. Imagine these types of savings, and even greater ones, across all aspects of business processes.

Higher up in the organisational strata are strategic and creative judgements that remain predominantly human—for now.

Over time, the automation frontier creeps upward: first, machines assist in doing the work, then machines just do the work, then they begin to manage slices of it, and eventually, they play a significant role in orchestrating most day-to-day operations. Now, Next, Future and Fully Autonomous—is a transition that is neither smooth nor uniform; capability advances in jumps, creating a shifting boundary that leaders must monitor and navigate.

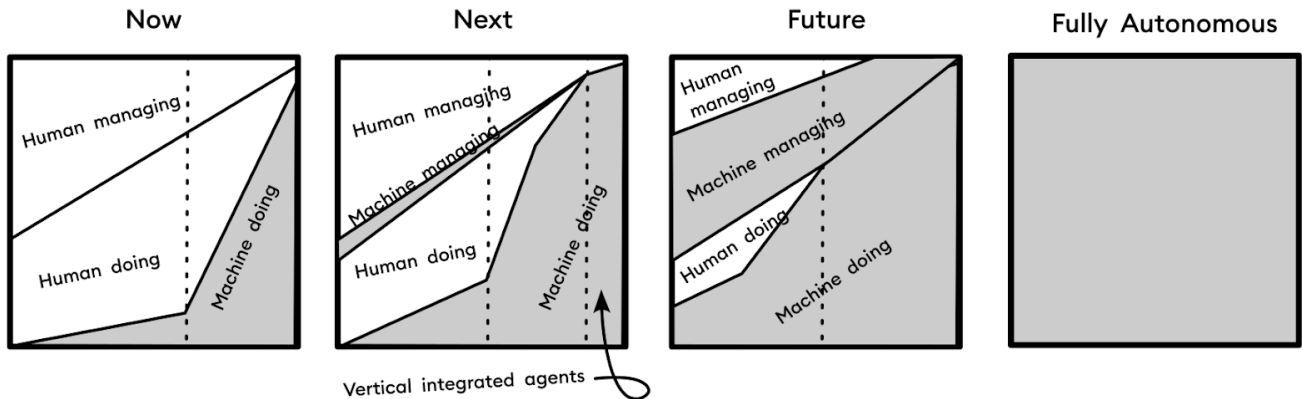


Figure 3 — Evolution Toward a Machine-Managed Enterprise. The four panels illustrate successive stages of automation. **Now** humans both manage and do most work; machine execution (grey area) is minimal and narrowly scoped. **Next** vertically integrated AI agents expand machine execution and begin assuming discrete management functions (narrow grey band near the top), while humans still oversee the majority of coordination and perform many tasks. **Future** machines handle the bulk of both execution and operational management; humans retain a shrinking slice focused on strategic oversight, model grounding and exception handling. A **Fully Autonomous** organisation operates end-to-end under machine control, without human involvement. The dotted vertical dividers in each panel mark how the boundary between human and machine roles shifts to the left as capability and confidence grow.

Approaching the Transition

The prudent route to a machine-managed future is to reframe work now, well before agentic systems reach full maturity.

When an organisation proactively revamps its management practices—mapping tasks, piloting hybrid decision-rights, and embedding firm data-governance guardrails—it moves ahead of the market frontier. This preparation shields it from the “Red Queen” trap—running hard just to stay in place— of later having to sprint to catch up with competitors that adopt new technologies earlier or more aggressively.

Early experimentation is essential. Even if today’s AI agents remain imperfect, they are improving quickly; once their capability crosses a threshold, the shift from human-managed to machine-managed workflows will accelerate with little warning.

Companies that re-engineer how decisions are made—changing the head of the organisation, not merely its fingers and toes—will ultimately outpace firms that string together isolated AI agents. This deeper transformation will likely reshape the technology stack itself. Rather than today’s disconnected strata, we should expect verticalised AI platforms that bundle data, models, and workflows around specific industries

or problem domains. Treating machine management as an enterprise-architecture mandate, rather than a bolt-on feature, allows leaders to align governance, pipelines, and talent into a single, coherent programme.

Firms that adopt this holistic approach will become genuinely AI-ready and be best positioned to absorb rapid advances as they emerge, scaling them safely across the value chain.

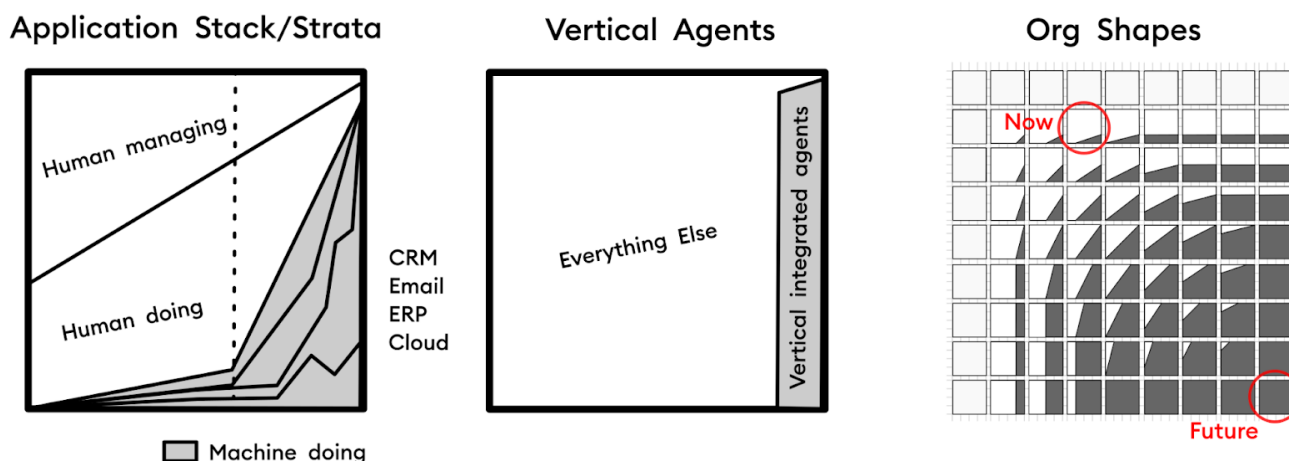


Figure 4 — Tech Strata, Agent Models and Organisational Shape ***Application Stack/Strata** Today’s software layers are largely “human-managed/human-doing,” but machine execution (grey wedges) is creeping upward—from cloud infrastructure through ERP, email, and CRM—pushing a dashed automation frontier into managerial territory. **Vertical Agents** The horizontal patchwork of generic tools gives way to vertically integrated AI agents (grey bar) that own end-to-end industry workflows. However, a lot of work (“Everything Else”) will resist the development of fully agentic systems in the immediate future. **Org Shapes** Each square represents a state of organisational automation. White indicates human execution; grey marks machine execution. The circles show the transition: the upper-left cell (“Now”) is still human-dominant, whereas the lower-right cell (“Future”) is almost entirely automated—illustrating how the organisational footprint flattens and darkens as machine management scales across the enterprise.*

Concluding Thoughts

There is no single blueprint; each industry, and indeed each firm, will trace its own path as the automation frontier advances. The leadership imperative is to view machine management not as a one-off project but as a strategic capability that must be cultivated ahead of time.

Organisations that treat the transition as an architectural redesign—integrating vertical AI platforms, transparent governance, and human oversight—will operate at algorithmic speed while reserving human capability where it creates the highest value. In doing so, they will secure a durable edge in the next era of business.

Further Reading:

Dell’Acqua, F., McFowland III, E., Mollick, E., Lifshitz-Assaf, H., Kellogg, K.C., Rajendran, S., Kraymer, L., Candelon, F. and Lakhani, K.R. (2023) Navigating the jagged technological frontier: Field experimental evidence of the effects of AI on knowledge-worker productivity and quality. Working Paper 24-013. Boston: Harvard Business School. pdf