

03 / STRATEGIC PLAYBOOK

NLT143 RESEARCH

# Capability, operating model, and risk.

*Build, buy, or partner. A Deloitte-format playbook for actuators as a strategic asset.*

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# Frame

If actuators are the chokepoint of physical AI, then capability around actuators is a strategic asset. The playbook below treats the asset as a system, not a part. Three lenses: capability model, operating model, risk register.

## Capability model

A firm's actuator capability is the sum of five sub-capabilities. Most firms are strong in two or three.

- **Specification.** Force, speed, duty cycle, environment, life. Most failures upstream of an actuator selection trace to bad specs.
- **Selection and sourcing.** Map a spec to a family, topology, and supplier in under a week.
- **Integration.** Mechanical mounting, thermal management, electrical interface, software handshake.
- **Manufacturing.** Tier-1 actuator production at humanoid platform volumes is its own discipline. Two to four years from a cold start.
- **Service and aftermarket.** Predictive maintenance, spares, end-of-life recycling. 30 to 50 percent of TCO over a 10-year life.

## Operating model

- **Below 1,000 units/year.** Buy off the shelf.
- **1,000 to 50,000 units/year.** Build a center of excellence. Standardize on three or four families. Two suppliers per family for redundancy.
- **Above 50,000 units/year.** Vertically integrate. Tesla, Figure, BYD, Aptronik are all in this band.

## Risk register

- **Single-source supply.** Especially harmonic drives or specialty motors out of Japan and Germany. Mitigate: qualify a second source on every SKU above the BOM 80th percentile by cost.
- **Geopolitical exposure.** Tariff or export-control disruption resets unit economics by 20 to 40 percent overnight. Mitigate: scenario-plan a domestic-only stack at 1.5x cost.
- **Specification creep.** A 10 percent late load-spec change can force a complete actuator family change. Mitigate: lock specs at gate 2, burden 25 percent margin on force, 40 percent on cycle life.
- **Reliability tail.** BLDC MTBF in factory air is 50,000 hours. Outdoor humanoid in construction: 8,000 hours. Mitigate: instrument every actuator with current and temperature telemetry from day one.
- **Talent concentration.** Three-digit globally. Mitigate: build internal apprenticeship loops. The system has to outlast the seniors.

## Build, buy, partner

- Volume below 1,000/year → **buy**.
- Volume 1,000 to 50,000 → **partner**. Two suppliers per family. Co-engineer, do not build.
- Above 50,000 with stable spec → **build**. Vertically integrate the top three SKUs by cost.
- Above 50,000 with unstable spec → **buy aggressively for one more cycle**, revisit.
- **Always** internalize specification and integration. Never outsource those.