

Physical AI Venture Diligence: Hardware, Software, Certification and Manufacturing

An Evidence-Gated Framework for System Readiness, Production Risk and Milestone Financing

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Abstract

Physical-AI ventures combine software intelligence with sensors, embedded compute, actuators, mechanics, communications and human interaction. Their investment case can fail when a successful demonstration is treated as a qualified product, certification is separated from engineering, manufacturing yield is assumed, or field service and working capital are omitted. This paper develops an evidence-gated framework for physical-AI venture diligence. Forty modules connect the venture question, system architecture, intended use, technology and manufacturing readiness, hazards, safety functions, operating domain, sensors, actuators, compute, models, fusion, integrated validation, ground truth, long-tail scenarios, human factors, cybersecurity, reliability, maintainability, certification, documentation, quality management, bill of materials, suppliers, process qualification, yield, capacity, configuration, change, deployment, service, unit economics, working capital, customer evidence, intellectual property, milestone financing, valuation, investor protections and close gates. Five figures, five tables, eight frequently asked questions and twenty-six primary or authoritative references support product-, domain-, jurisdiction-, supplier-, firm- and period-specific review. The framework ties technical evidence to cash requirements, transaction protections and venture value. It does not certify a product or establish that a venture is safe, compliant, investable or suitable for a particular purpose and does not substitute for authorised engineering, safety, quality, manufacturing, legal, tax, accounting, financing, insurance or regulatory advice.

JEL Classification: G24, L64, L69, O32, C45, K32, M13

Keywords: physical AI, venture diligence, robotics, certification, manufacturing readiness, production yield, field service, milestone financing, venture valuation

1. Frame the venture decision

Define product, customer, operating domain, financing stage and milestone claim.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an approved diligence charter. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when technology excitement replaces an investable question. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for frame the venture decision should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

2. Map the complete system

Trace sensors, compute, models, decision logic, actuators, communications, people and recovery.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a system architecture. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when software is reviewed without the physical control loop. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for map the complete system should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

3. Define intended use

Specify users, environment, task, boundaries, exclusions and consequence.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an intended-use statement. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when a broad demo becomes an unlimited product claim. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for define intended use should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

4. Assess technology readiness

Separate research, prototype, pilot, qualified product and scaled operation.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a readiness ladder. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when one successful demonstration is treated as production readiness. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

The decision pack for assess technology readiness should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

5. Assess manufacturing readiness

Review process definition, tooling, suppliers, quality controls, yield and capacity.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a manufacturing-readiness assessment. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when technical readiness is confused with repeatable manufacture. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for assess manufacturing readiness should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

6. Map hazards and failure modes

Connect initiating events, exposure, severity, controls and residual risk.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a controlled hazard register. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when rare severe failures disappear inside average performance. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for map hazards and failure modes should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

7. Allocate safety functions

Assign detection, prevention, intervention, safe state and recovery across hardware, software and people.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a safety-function allocation. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when responsibility falls between subsystems. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for allocate safety functions should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

8. Bound the operating domain

Specify lighting, weather, terrain, temperature, vibration, connectivity and human presence.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an operating-domain specification. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when field deployment exceeds the tested domain. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

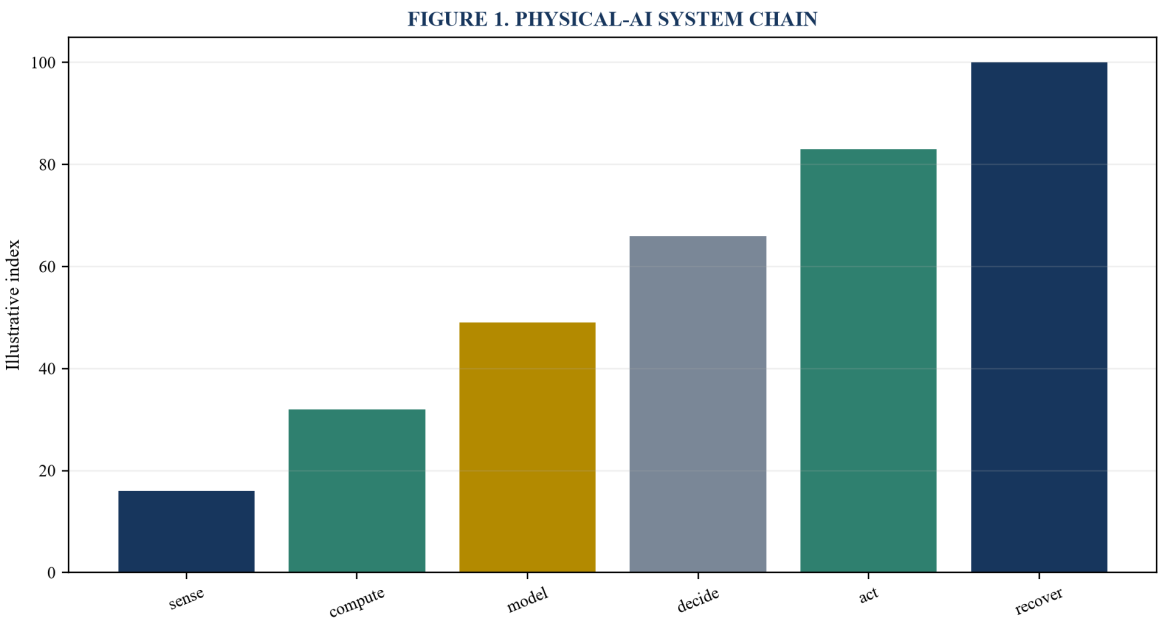
The decision pack for bound the operating domain should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

Table 1. Physical-AI system layers

Layer	Question	Evidence
sense	what is observed	sensor tests
decide	what action is selected	model evidence
act	what changes physically	actuator tests
recover	how failure is bounded	safety case

Illustrative controls require product-, domain-, jurisdiction-, supplier-, firm- and period-specific approval.

Figure 1. Physical-AI system chain



Values are illustrative indices and require replacement with approved technical and financial evidence.

9. Audit sensors and calibration

Test range, precision, drift, occlusion, contamination, timing and calibration controls.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a sensor assurance pack. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when model performance rests on unstable physical inputs. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for audit sensors and calibration should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

10. Audit actuators and mechanics

Test authority, accuracy, backlash, wear, load, endurance and failure response.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an actuation evidence pack. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when correct decisions produce ineffective physical action. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for audit actuators and mechanics should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

11. Audit embedded compute

Review processors, accelerators, memory, power, thermal limits and lifecycle.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a hardware capacity model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when the compute platform cannot sustain the production workload. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for audit embedded compute should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

12. Audit the model stack

Review data, training, evaluation, uncertainty, thresholds, versions and drift.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a model evidence dossier. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when benchmark scores lack operating relevance. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

The decision pack for audit the model stack should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

13. Test sensor fusion

Evaluate synchronization, association, conflict, uncertainty and graceful degradation.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a fusion validation report. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when correlated errors create confident failure. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for test sensor fusion should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

14. Test end-to-end performance

Measure sensing-to-action outcomes across representative scenarios.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an integrated validation report. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when component tests never prove system behaviour. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for test end-to-end performance should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

15. Construct ground truth

Use independent labels, measurements, adjudication and provenance.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a governed reference corpus. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when developer judgments become unquestioned truth. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for construct ground truth should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

16. Sample long-tail scenarios

Cover boundary, degraded, misuse, near-miss and emergency conditions.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a risk-weighted test plan. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when clean test sets omit venture-ending failure modes. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

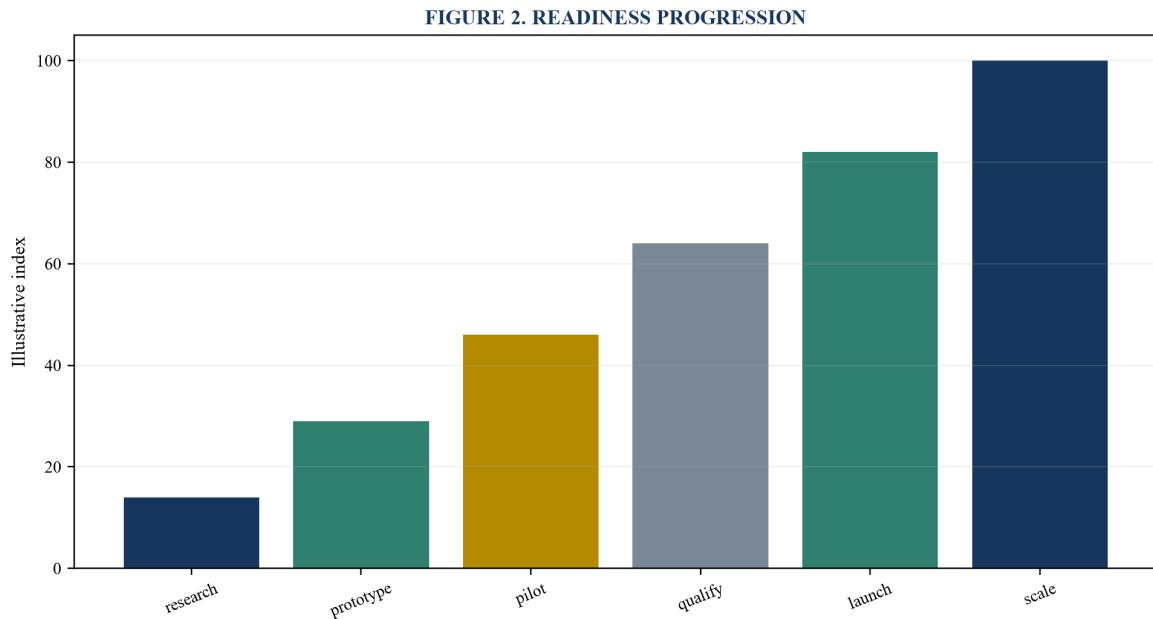
The decision pack for sample long-tail scenarios should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

Table 2. Readiness ladder

Stage	Primary evidence	Financing implication
prototype	controlled function	technical option
pilot	operating-domain result	market evidence
qualified	safety and certification	launch capital
scaled	yield and service	growth capital

Illustrative controls require product-, domain-, jurisdiction-, supplier-, firm- and period-specific approval.

Figure 2. Readiness progression



Values are illustrative indices and require replacement with approved technical and financial evidence.

17. Evaluate human interaction

Test attention, comprehension, override, handover, maintenance and misuse.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a human-factors assessment. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when the system assumes ideal operator recovery. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for evaluate human interaction should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

18. Review cybersecurity

Assess identity, secure boot, keys, updates, networks, APIs, tamper and recovery.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a cyber-safety dossier. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when cyber compromise creates physical consequences. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for review cybersecurity should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

19. Review reliability

Model component failure, wear, diagnostics, spares, repair and availability.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a reliability and availability model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when prototype uptime is extrapolated to commercial fleets. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for review reliability should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

20. Review maintainability

Assess access, diagnostics, modularity, service time, tools and technician capability.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a maintainability plan. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when field service destroys gross margin and uptime. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

The decision pack for review maintainability should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

21. Map certification routes

Identify machinery, vehicle, aviation, medical, product, radio and sector pathways by market.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a certification roadmap. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when regulatory sequencing is absent from the financing plan. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for map certification routes should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

22. Audit technical documentation

Trace requirements, design, risks, tests, versions, changes and approvals.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a technical-file index. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when claims cannot be reconstructed for certification or incidents. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for audit technical documentation should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

23. Review quality management

Assess design control, supplier quality, deviations, CAPA, change and release authority.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a quality-system assessment. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when production problems lack accountable correction. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for review quality management should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

24. Map the bill of materials

Identify critical parts, cost, sources, lead times, minimum orders and substitutes.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a controlled bill of materials. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when the margin case ignores constrained components. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

The decision pack for map the bill of materials should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

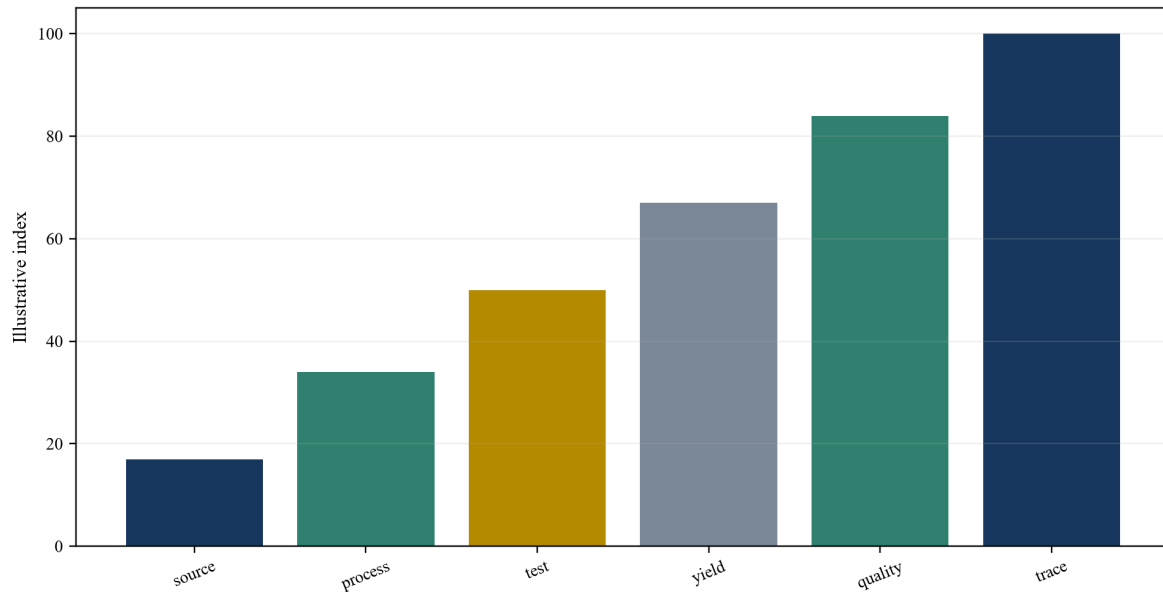
Table 3. Manufacturing risk controls

Risk	Measure	Completion evidence
supply	lead time and concentration	qualified source
process	capability and traceability	approved line
yield	scrap and rework	stable output
quality	escapes and CAPA	closed actions

Illustrative controls require product-, domain-, jurisdiction-, supplier-, firm- and period-specific approval.

Figure 3. Manufacturing assurance

FIGURE 3. MANUFACTURING ASSURANCE



Values are illustrative indices and require replacement with approved technical and financial evidence.

25. Assess supplier concentration

Review single-source parts, contract rights, tooling ownership, capacity and geographic exposure.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a supply resilience plan. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when scale depends on one fragile supplier. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for assess supplier concentration should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

26. Test production process

Review work instructions, tolerances, metrology, test stations and traceability.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a process qualification plan. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when repeatability is assumed from engineering builds. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for test production process should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

27. Measure yield and scrap

Track first-pass yield, rework, scrap, escapes and learning curves.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a yield economics model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when gross margin assumes mature yield from launch. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for measure yield and scrap should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

28. Plan capacity ramp

Connect equipment, facilities, labour, cycle time, shifts and supplier capacity to demand.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a capacity ramp model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when sales growth outruns production capability. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

The decision pack for plan capacity ramp should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

29. Control configuration

Track hardware revisions, firmware, models, thresholds, suppliers and customer variants.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a configuration baseline. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when the installed fleet becomes untestable. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for control configuration should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

30. Control product changes

Require impact analysis, regression testing, certification review and rollback.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a change-control process. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when continuous improvement invalidates approved evidence. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for control product changes should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

31. Plan field deployment

Cost installation, commissioning, training, connectivity, spares and acceptance.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a deployment operating model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when revenue assumptions omit site readiness and deployment labour. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for plan field deployment should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

32. Plan field service

Model diagnostics, preventive maintenance, swaps, repair depots, warranties and response times.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a field-service economics model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when service obligations overwhelm the venture. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

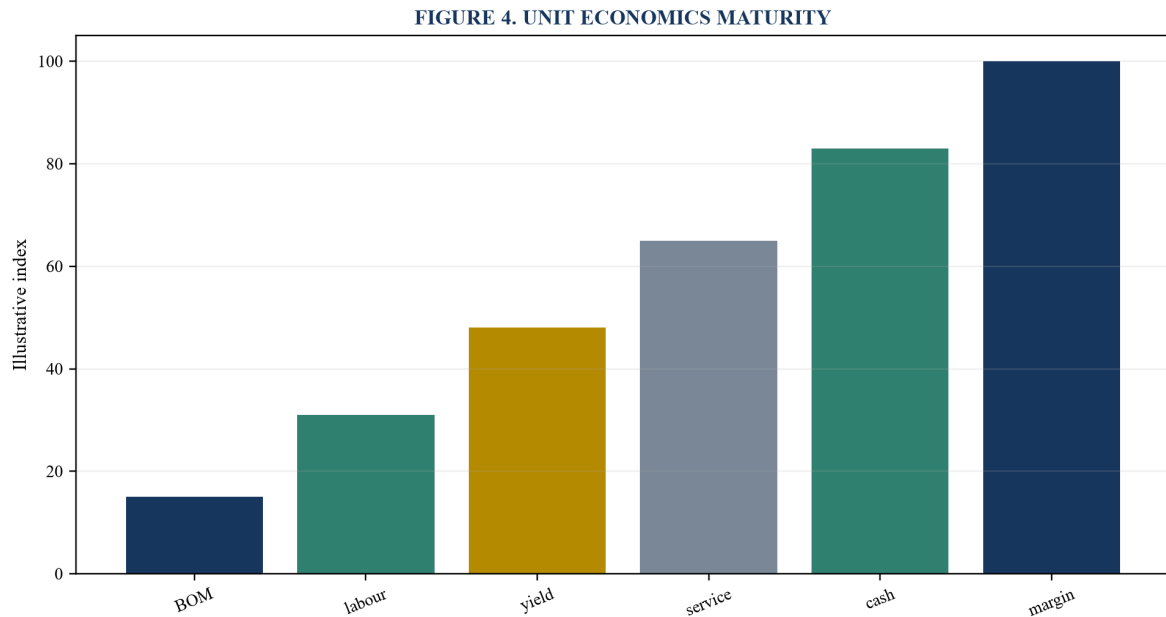
The decision pack for plan field service should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

Table 4. Venture economics

Driver	Evidence	Value link
BOM	current supplier quotes	gross margin
yield	production history	unit cost
service	field records	retention
working capital	cash cycle	funding need

Illustrative controls require product-, domain-, jurisdiction-, supplier-, firm- and period-specific approval.

Figure 4. Unit economics maturity



Values are illustrative indices and require replacement with approved technical and financial evidence.

33. Measure unit economics

Connect BOM, manufacturing, logistics, cloud, support, warranty and financing costs.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a contribution-margin bridge. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when software-style margins are applied to a physical product. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for measure unit economics should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

34. Model working capital

Forecast inventory, deposits, receivables, spares, warranties and production commitments.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a working-capital model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when growth creates an unfunded cash trough. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for model working capital should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

35. Test customer evidence

Review pilots, acceptance criteria, utilisation, outcomes, renewals and concentration.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a customer evidence scorecard. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when letters of intent substitute for repeatable demand. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for test customer evidence should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

36. Assess intellectual property

Map patents, code, data, designs, licences, employee rights and freedom to operate.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an IP and rights dossier. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when core assets are unowned or encumbered. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

The decision pack for assess intellectual property should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

37. Build milestone financing

Tie capital releases to technical, certification, yield, customer and margin evidence.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a milestone financing plan. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when funding follows calendar dates instead of risk retirement. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Physical-AI diligence should connect algorithms to sensors, compute, actuators, mechanics, people, manufacturing and field service.

The decision pack for build milestone financing should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

38. Stress valuation

Connect readiness, certification, yield, service, working capital and concentration to scenarios.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is a risk-adjusted valuation model. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when venture value ignores physical execution risk. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

A venture can retire risk through evidence gates spanning safety, certification, production yield, customer acceptance and unit economics.

The decision pack for stress valuation should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

39. Define investor protections

Structure information rights, milestones, reserves, covenants and governance for residual risks.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an investment protection schedule. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when identified gaps have no financing consequence. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Reviewers need versioned tests, representative operating conditions, accountable exceptions and a direct link from technical gaps to cash and valuation.

The decision pack for define investor protections should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

40. Close through gates

Require system evidence, safety, certification, production, demand, economics and funded execution.

The controlled record includes scope; version; operating domain; test; supplier; cost; source; reviewer; decision. The immediate deliverable is an accountable investment decision. Preserve jurisdiction, effective date, hardware and software version, operating domain, test condition, supplier, cost basis, reviewer, approval and unresolved exceptions.

The principal failure occurs when the venture scales before risks are retired. Reviewers should reproduce the evidence, test adverse conditions, reconcile technical and financial units and identify who may approve, remediate or withhold the investment recommendation.

Milestone financing can match capital release to demonstrable risk retirement across the complete product lifecycle.

The decision pack for close through gates should show the prior claim, tested evidence, correction, cash and value consequence, alternative response, owner, due date, next evidence gate and observed outcome. Material exceptions flow into milestones, reserves, transaction protections and valuation scenarios.

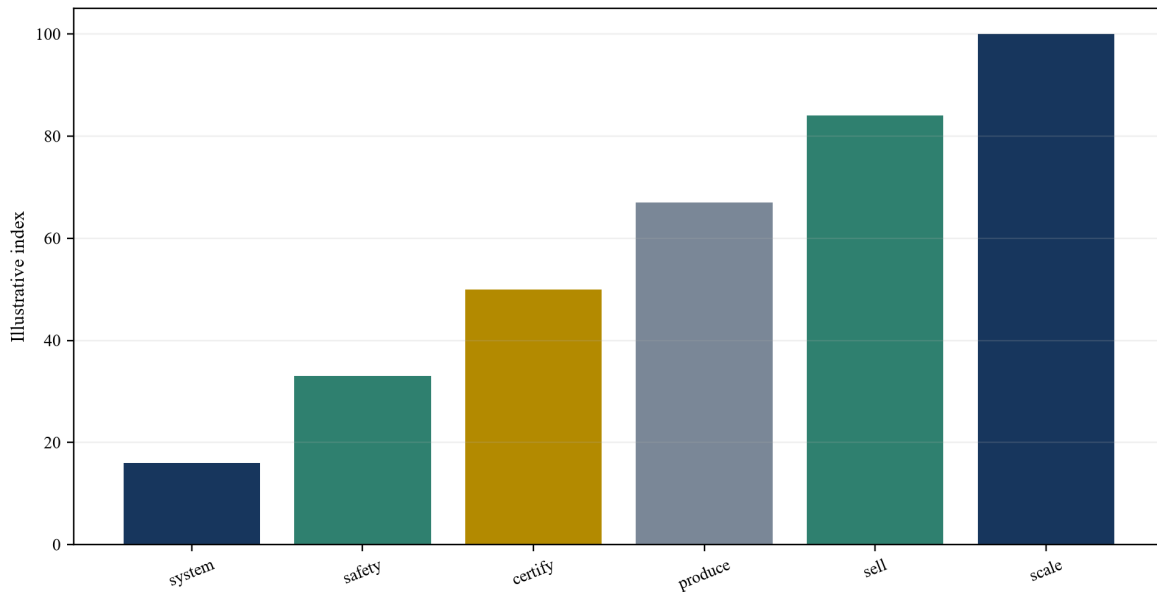
Table 5. Investment gates

Gate	Primary work	Completion evidence
system	integrated validation	reproduced outcome
market	certification and customers	approved route
scale	yield and capacity	qualified ramp
capital	milestones and reserves	accountable decision

Illustrative controls require product-, domain-, jurisdiction-, supplier-, firm- and period-specific approval.

Figure 5. Milestone financing gates

FIGURE 5. MILESTONE FINANCING GATES



Values are illustrative indices and require replacement with approved technical and financial evidence.

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Chennakeshav (CK) is a corporate finance and investment banking executive with 25+ years of global experience in deal origination, structuring and execution across M&A, growth capital and corporate strategy. He has led value-creation mandates for founders, corporates and funds — bridging the boardroom view to hands-on execution and close.

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