ERP, AI, AND ENTERPRISE ARCHITECTURE

A 36-Part Executive Masterclass for CFOs, CIOs, COOs, and Enterprise Leaders

PART 20 OF 36

MANUFACTURING SYSTEMS AND MRP II ARCHITECTURE

CORE TOPICS	KEY FRAMEWORKS	BOOKS REFERENCED
MRP II architecture and planning	MRP II Five-Component Architecture	The System Level CFO (2026)
Bill of materials governance	BOM Governance Framework (5)	Systems CFO Model (2026)
Standard costing methodology	Standard Costing Model (5)	ERP Implementation & Business Architecture (2026)
Manufacturing variance analysis	Variance Analysis (6 Types)	Beyond Linear Finance (2026)
Overhead absorption framework	Overhead Absorption Framework	AI Operating Framework & Governance (2026)
Make-vs.-buy analysis	Make-vs.-Buy Decision (5 Factors)	The Economics Edge (2026)
Inventory costing in manufacturing	Inventory Costing in Manufacturing	
Capacity management and capex	Capacity Investment Decision (5)	
ERP manufacturing controls	ERP Manufacturing Controls (5)	
Manufacturing financial benchmarks	Manufacturing KPI Architecture (7)	
	Manufacturing Scorecard (8 Metrics)	
	Manufacturing Investment Case	

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PART 20 • SECTION IV: OPERATIONS, MANUFACTURING, AND SUPPLY CHAIN SYSTEMS

Manufacturing Systems and MRP II Architecture

Production Planning, BOM Governance, Standard Costing, Variance Analysis, and Manufacturing Controls

Manufacturing is one of the most complex operational domains in enterprise systems governance — not because manufacturing processes are inherently complex, but because the intersection of physical production planning, inventory management, cost accounting, and quality control creates financial data flows of significant breadth and depth. The Systems CFO in a manufacturing enterprise must understand the financial architecture of production: how raw materials become finished goods, how costs are accumulated and allocated through the production process, and how production decisions directly affect the income statement, balance sheet, and cash flow statement.

Manufacturing enterprises face a distinctive financial governance challenge: production decisions made weeks or months in advance of customer orders create commitments to inventory investment and capacity utilization that are difficult to reverse without cost. Over-production creates excess inventory — working capital waste with real carrying cost and obsolescence risk. Under-production creates stockouts — lost revenue, expediting cost, and customer service failures. The quality of the manufacturing planning systems and the financial governance of those systems determines which of these failure modes the enterprise experiences and how severely.

This Part develops the complete manufacturing financial architecture: the MRP II planning framework that translates demand into production commitments, the Bill of Materials governance that determines cost accuracy, the standard costing system that values inventory and COGS, the variance analysis that reveals operational efficiency and inefficiency, the overhead absorption framework that allocates fixed costs to production, and the manufacturing financial controls that protect the integrity of manufacturing financial data.

1. MRP II ARCHITECTURE: THE MANUFACTURING PLANNING SYSTEM

Manufacturing Resource Planning (MRP II) is the integrated planning framework that connects demand forecasts to production schedules, production schedules to material requirements, material requirements to procurement, and procurement to financial plans. Understanding MRP II is essential for the Systems CFO because every MRP II planning decision has a direct financial consequence: the production schedule determines WIP levels and cash conversion cycle; the material requirements plan determines purchase commitments and AP timing; and the capacity plan determines capital expenditure requirements. The financial plan is downstream of MRP II; the Systems CFO who does not understand the MRP II logic cannot govern the financial plan that depends on it.

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MRP II Component	Planning Horizon	Financial Commitment Created	Financial Data Generated
Demand Planning	13 weeks to 18 months; statistical forecast + customer order inputs	Production capacity commitments; raw material forecasts that drive supplier relationship investment; inventory build-plan for seasonal demand	Revenue forecast input; inventory projection by period; capacity utilization forecast; working capital requirement by period
Master Production Schedule (MPS)	1-13 weeks; the authorized production commitment; capacity-constrained view of what will actually be made	Authorized production plan commits: labor scheduling and overtime; machine time allocation; raw material draw-down timing	WIP forecast by period; overhead absorption forecast; direct labor cost forecast; capacity cost vs. revenue alignment
Material Requirements Planning (MRP)	Same as MPS (1-13 weeks); explosion of MPS through BOM to component level	Purchase order creation (planned and firm); inventory replenishment orders; supplier lead time commitments; safety stock replenishment	AP commitment forecast by period; inventory build-up projection; cash outflow for materials; purchase price variance risk
Capacity Requirements Planning (CRP)	Same as MPS; validates that MPS is achievable within current capacity; identifies constraint points	Overtime authorization if capacity short; subcontract decisions if constraint cannot be resolved internally; capital investment trigger if persistent constraint	Labor cost variance from overtime; subcontract cost vs. make cost; capital investment ROI from capacity constraint resolution

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Shop Floor Control (Execution)	Real-time to 1 week; actual production vs. plan; captures what actually happened vs. what was planned	Actual labor and machine time committed; actual material consumption confirmed; WIP status and cost accumulation	Actual vs. standard cost variance capture; production efficiency data; WIP balance by production order; scrap and rework cost capture

2. BILL OF MATERIALS: THE COST ARCHITECTURE FOUNDATION

The Bill of Materials is the engineering specification of everything that goes into a finished product — every component, sub-assembly, and raw material with its quantity per unit. From the Systems CFO's perspective, the BOM is simultaneously the product specification and the cost architecture: the standard cost of each finished product is calculated by exploding the BOM through all component costs, then adding routing-based labor and overhead costs. If the BOM is inaccurate, the standard cost is inaccurate, and every unit produced is valued incorrectly in inventory and cost of goods sold. BOM accuracy is therefore one of the most consequential data quality requirements in manufacturing financial governance.

BOM Governance Element	Standard	Frequency of Audit	Financial Consequence of Non-Compliance
BOM accuracy	BOM reflects actual components and quantities used in production; engineering changes updated in ERP within 24 hours of Engineering Change Order (ECO) approval; yield factors included for materials with consistent yield loss	Quarterly for A-category SKUs by COGS value; semi-annually for B-category; annually for C-category; triggered by production variance anomaly	Standard cost calculated from wrong BOM; COGS systematically misstated; inventory valued incorrectly; cost variance reports misleading; pricing decisions made on wrong margin data

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Engineering change management	Engineering Change Order (ECO) approved by engineering and manufacturing before BOM is updated; cost impact of ECO calculated by finance before approval; effective date in ERP matches ECO approval date	Per ECO — immediate; retrospective audit of all ECOs quarterly to confirm BOM was updated within 24 hours of approval	BOM and actual production diverge; WIP valued at wrong standard during transition; inventory adjustment required at period-end; variance analysis impossible to interpret when BOM and routing are inconsistent
Yield and scrap factors	BOM includes yield factors for materials consumed beyond the theoretical quantity (e.g., 1.05 yield factor for material with 5% typical yield loss); scrap rates updated when actual production data shows persistent deviation from standard	Semi-annual review of yield factors vs. actual production data; triggered by material usage variance above threshold for two consecutive months	Standard cost understates actual material cost if yield factors not captured; COGS understated in financial statements; pricing set below cost recovery if standard cost is understated
Component substitution tracking	Approved substitute components documented in ERP; actual substitution during production triggers BOM variance reporting; substitute cost compared to primary component standard cost	Per substitution event; monthly review of substitution frequency to determine if permanent BOM update is warranted	Substitution cost difference appears as unexplained material variance; actual COGS differs from reported COGS; inventory valuation error if substitution is not tracked in system

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Multi-level BOM integrity	All sub-assembly BOMs accurate and correctly linked to parent BOMs; where-used analysis maintained for all components; phantom BOMs vs. stocked sub-assemblies correctly classified	Annual full-BOM integrity check; triggered by MRP explosion error or purchase order for component not in BOM	MRP explosion errors create wrong purchase orders; incorrect material requirements planning; purchased component not consumed by production order; inventory imbalance develops over time

3. STANDARD COSTING: THE MANUFACTURING FINANCIAL MODEL

Standard costing — the assignment of predetermined per-unit costs to manufactured products, with the difference between standard and actual cost reported as a variance — is the dominant cost accounting methodology in manufacturing enterprises. Standard costing provides the framework for: inventory valuation (inventory is carried at standard cost, not actual cost), COGS calculation (production completions credit WIP at standard cost, with variances posted separately), and performance measurement (variances reveal where actual production performance deviated from plan). The Systems CFO governs all five components of the standard cost with specific update cadences, data source standards, and validation requirements.

Standard Cost Component	Calculation Method	Data Source	Annual Update Standard
Material standard cost	BOM component quantity × component standard purchase price; yield factor applied where material loss is expected; multi-level explosion through all BOM levels to compute material cost of each finished good	BOM quantity from Engineering; purchase price from current supplier contracts or most recent 12-month weighted average purchase price from ERP AP history	Annual: update component prices from current contracts; interim update when component price change exceeds 5%; roll-up through all BOM levels; document COGS impact of price changes for management and board briefing

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Direct labor standard cost	Routing time per operation (minutes or hours from industrial engineering time study) × labor rate per hour for the work center skill level; different rates for different skill classifications within same plant	Routing from industrial engineering or time study; labor rates from HRIS by skill classification including burden (benefits, payroll taxes) from HR	Annual: update routing times if process changed; update labor rates from HRIS after annual merit cycle; document labor efficiency assumptions; verify routing accuracy with production team
Variable overhead standard	Machine hours or direct labor hours per unit × variable overhead rate for work center; variable overhead rate calculated from budgeted variable overhead ÷ budgeted activity level (hours)	Budgeted variable overhead from operating budget; budgeted activity from MPS; variable overhead rate by work center or cost pool	Annual with budget cycle: recalculate variable overhead rate from updated overhead budget; interim update if structural change in variable overhead cost (utility rate change, outsourced overhead service cost change)
Fixed overhead standard	Machine hours or direct labor hours per unit × fixed overhead rate calculated at normal (not actual) capacity; normal capacity is the expected average over 3-5 years, not the peak or current actual	Budgeted fixed overhead from operating budget (rent, depreciation, plant management salaries, insurance); normal capacity from production engineering	Annual: recalculate from updated fixed overhead budget; normal capacity reviewed every 3 years or when plant capacity changes materially; over/under absorption monitored monthly
Total standard cost per unit	Sum of material standard + direct labor standard + variable overhead standard + fixed overhead standard; represents the budgeted cost of one unit of finished good at normal capacity utilization	Calculated in ERP after all component inputs updated; verified against prior year standard with change explanation; reviewed by Controller before approval	Annual roll-up after all inputs updated; interim update when any component changes >5%; board briefed on gross margin impact of standard cost changes; effective date set for inventory revaluation

4. MANUFACTURING VARIANCE ANALYSIS: THE COST INTELLIGENCE SYSTEM

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Manufacturing variance analysis — the decomposition of the difference between standard and actual manufacturing costs — is the primary mechanism through which the Systems CFO identifies operational efficiency opportunities and financial risk in the production function. Each variance category has a specific operational root cause and a specific management response. Confusing variance types — attributing a labor efficiency problem to a rate problem, or a material price problem to a usage problem — produces wrong operational responses that fail to address the actual issue and waste management attention. The Systems CFO must understand the mechanics of each variance calculation and the typical operational causes to govern the variance analysis function effectively.

Variance Type	Formula	Operational Root Cause	Management Response
Material price variance (MPV)	(Actual price – Standard price) × Actual quantity purchased; favorable when actual price < standard; calculated at point of purchase	Commodity price movement beyond plan; supplier renegotiation outcome; emergency procurement at premium; specification change requiring more expensive material	Commodity hedging for significant exposure; supplier renegotiation if variance is persistent; procurement process review if premium sourcing; standard update if permanent price change
Material usage variance (MUV)	(Actual quantity used – Standard quantity) × Standard price; favorable when actual usage < standard; reveals whether BOM quantity is accurate	Yield loss above standard; scrap rate higher than BOM yield factor; operator error; BOM inaccuracy (standard wrong); material quality issue from supplier	Root cause analysis: process parameter investigation; operator training; equipment maintenance; BOM accuracy audit; supplier quality review if material defect
Labor efficiency variance (LEV)	(Actual hours – Standard hours) × Standard rate; favorable when actual hours < standard; measures whether production takes longer than the routing standard	Machine downtime reducing throughput; setup time above standard; operator skill below routing assumption; product complexity change; routing inaccuracy	OEE improvement program; setup time reduction (SMED methodology); operator training; routing time study if standard is consistently missed; capacity planning if downtime is structural

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Labor rate variance (LRV)	(Actual rate – Standard rate) × Actual hours; favorable when actual rate < standard; measures whether the cost per hour matches the standard	Overtime premium paid for production required beyond regular hours; higher-skilled operator deployed on lower-skill routing; merit increases not reflected in standard; shift differential cost	Scheduling to avoid unnecessary overtime; routing accuracy review if wrong skill level assigned; standard update at annual merit cycle; labor mix management to align skill to routing assumption
Variable overhead efficiency variance	(Actual hours – Standard hours) × Standard variable overhead rate; driven by the same hours variance as labor efficiency; absorbs more or less VarOH based on hours	Same drivers as labor efficiency variance; volume of overhead varies with activity; variable overhead is spent at rate driven by actual activity level	Address through labor efficiency improvement; variable overhead itself governed through overhead spending variance; efficiency variance is a consequence of activity level, not a separate issue
Fixed overhead volume variance	(Actual output – Budgeted output at normal capacity) × Fixed overhead rate; under-absorption when volume below normal; over-absorption when above normal	Production volume below normal capacity (under-absorption — fixed cost not recovered); volume above normal (over-absorption — more fixed cost absorbed than incurred)	Under-absorption: investigate demand forecast accuracy; pricing strategy; capacity rationalization if chronic; over-absorption: monitor inventory build from over-production

5. OVERHEAD ABSORPTION: THE FIXED COST ALLOCATION ARCHITECTURE

Overhead absorption — the mechanism by which fixed manufacturing overhead costs are allocated to production and flow into inventory and COGS — is one of the most consequential and least intuitively understood elements of manufacturing financial governance. When the enterprise produces at normal capacity, fixed overhead is fully absorbed into inventory (over-absorption is a P&L; credit; under-absorption is a P&L; charge). When production falls below normal capacity, fixed overhead is under-absorbed — meaning that the production volume did not generate enough absorption credits to cover the fixed overhead incurred, creating an immediate P&L; charge. This mechanism means that volume decisions directly affect reported profitability in ways that are not always intuitively obvious to operational management.

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Overhead Absorption Element	Design Standard	Financial Governance Requirement
Normal capacity definition	Normal capacity is the expected production volume over a 3-5 year period, reflecting expected demand patterns including seasonality; it is not the theoretical maximum capacity or the budgeted current-year volume	Normal capacity documented and CFO-approved; reviewed every 3 years or when plant capacity changes materially; normal capacity drives the fixed overhead rate used for standard costing; change in normal capacity changes standard cost and requires board disclosure
Fixed overhead rate calculation	Budgeted fixed overhead ÷ normal capacity activity (machine hours or direct labor hours); calculated annually from the overhead budget; applied to production at the standard rate per unit of activity	Annual rate calculation from approved overhead budget; rate locked for the year to enable consistent standard costing; rate change from prior year explained and documented; gross margin impact of rate change calculated and disclosed
Over- and under-absorption reporting	Monthly calculation of absorbed overhead (standard rate × actual production activity) vs. actual fixed overhead incurred; difference is over-absorption (favorable: production above normal) or under-absorption (unfavorable: below normal)	Monthly absorption variance reported to management as part of manufacturing financial package; chronic under-absorption investigated for: volume below plan (demand issue), normal capacity set too high (planning issue), or actual overhead above budget (cost control issue)
Period-end absorption posting	Under-absorbed overhead posted to P&L; as period cost (not capitalized to inventory); over-absorbed overhead credits P&L; material year-end over/under absorption reviewed for appropriateness of normal capacity assumption	Controller reviews and posts monthly absorption variance; large or unusual absorption variances escalated to CFO; year-end audit of normal capacity assumption and absorption rate for external auditor assessment

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6. MAKE-VS.-BUY ANALYSIS: THE MANUFACTURING CAPITAL ALLOCATION FRAMEWORK

The make-vs.-buy decision — whether to manufacture a component internally or purchase it from an external supplier — is one of the most consequential financial architecture decisions in manufacturing. It determines capital investment requirements, fixed cost structure, supply chain vulnerability, quality control capability, and strategic differentiation potential. The Systems CFO provides the financial architecture for this decision — ensuring it is made on rigorous economic grounds with full consideration of the relevant costs rather than on historical inertia or incomplete analysis.

Analysis Factor	Make (Internal Production)	Buy (External Sourcing)	Financial Analysis Required
Variable cost comparison	Standard variable cost per unit: material + direct labor + variable overhead; excludes fixed costs already committed (sunk or continuing regardless of make/buy)	Supplier quoted price per unit at expected volume; include inbound freight, inspection cost, and any yield difference between supplier and internal quality	At what volume does make variable cost equal buy price? (breakeven volume analysis); marginal cost of make when capacity already exists (use marginal cost, not full absorption cost)
Fixed cost impact	If additional capacity required for make: incremental capex + depreciation + fixed maintenance + dedicated labor; if using existing capacity: opportunity cost of capacity used for lower-margin make vs. alternative	No fixed cost investment; but volume commitment may be required for competitive pricing; tooling investment may be required for supplier to produce to specification	Incremental fixed cost of make ÷ (buy price – variable cost of make) = breakeven volume; opportunity cost of capacity: could the capacity generate higher margin from another product?
Quality and IP control	Direct control of quality and process; proprietary process knowledge protected; faster response to quality issues; learning curve benefits retained internally	Dependent on supplier quality management system; specification must be fully documented; IP exposure if process knowledge transferred; slower response to field quality issues	Quality cost economics: prevention and appraisal cost vs. external failure cost; warranty reserve implications; IP value of process knowledge retained vs. make cost premium over buy cost

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Supply chain risk	Dependency on internal capacity only; single point of failure if equipment fails or labor unavailable; but fully controllable and no external dependency	Dependency on external supplier; disruption risk if supplier fails, is acquired, or experiences quality failure; geographic and geopolitical risk if single source in one region	Supply chain resilience analysis: cost of dual-source vs. risk of single-source failure; supplier financial health assessment; geographic concentration risk; strategic inventory buffer for buy decision
Strategic value alignment	Make aligns with core competency if manufacturing is a differentiation point; vertical integration provides control of customer experience and quality	Buy frees capital and management attention for core competency investment; outsourcing non-core manufacturing to focus on differentiated capabilities	Does the manufacturing capability create competitive advantage that justifies the make premium? Is this a core or non-core manufacturing competency for the enterprise's strategic positioning?

7. MANUFACTURING INVENTORY COSTING: THE BALANCE SHEET ARCHITECTURE

Manufacturing inventory has three components on the balance sheet, each with distinct valuation requirements and governance standards. The accuracy and reliability of manufacturing inventory valuations directly affect the balance sheet asset value, the COGS calculation and gross margin, and the working capital analysis that drives capital allocation decisions. Inventory valuation errors are particularly difficult to detect and correct: they can accumulate over multiple periods before an annual physical inventory or external audit reveals the discrepancy.

Inventory Category	Valuation Basis	Key Financial Control	Common Misstatement Risk
Raw materials	Standard or average cost from purchase price; FIFO or weighted average methodology; actual cost for specific identification items (precious metals, unique components)	Receiving confirmation matches PO; physical count verifies system balance; cost updates when purchase prices change materially; obsolete materials identified and reserved	Overstatement if obsolete materials not written down; understatement if cost roll not performed after significant price increases; phantom inventory if receiving discrepancies not investigated

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Work-in-progress (WIP)	Standard cost of materials issued to production order + standard direct labor charged + applied overhead at standard rate × actual activity; or actual cost accumulation if job order costing	WIP reconciled to open production orders weekly; aged WIP (production orders open longer than production cycle) investigated; production orders closed timely; completion confirmations required before FG posting	Overstatement if production orders not closed after completion; understatement if materials issued but completion not recorded; overhead application error if activity base is incorrect
Finished goods	Standard cost (material + labor + overhead) at completion, as calculated in annual standard cost roll-up; actual cost if process manufacturing; lower of cost or net realizable value (NRV) applied	Physical count accuracy monitored through cycle count program; finished goods receipt confirmed in WMS before system update; standard cost roll updated annually; NRV assessment for slow-moving SKUs	Overstatement if NRV below standard cost for obsolete or slow-moving items; standard cost stale after material price changes; shrink between production and shipping not captured
Overhead in inventory (US GAAP vs. IFRS)	US GAAP (ASC 330): fixed overhead included in inventory at normal capacity rate; abnormal amounts of idle facility expense expensed in period; IFRS (IAS 2): same treatment for most practical purposes	Overhead rate applied consistently; abnormal costs identified and expensed in period incurred; normal capacity determination documented and defensible; under-absorption analysis monthly	Abnormal idle facility costs capitalized (overcapitalize inventory); normal capacity set too high to maximize inventory absorption; overhead absorbed at above-normal rates creating inventory overstatement

8. CAPACITY MANAGEMENT: THE MANUFACTURING CAPEX DECISION FRAMEWORK

Manufacturing capacity decisions — whether to invest in additional production capacity, how much capacity to maintain, and when to reduce capacity — are among the most consequential capital allocation decisions the Systems CFO supports. The financial framework for capacity decisions connects operational measures (OEE, utilization rate, throughput) to financial outcomes (capex investment, incremental contribution margin, payback period) through a disciplined analysis that prevents both under-investment (missed revenue and customer service failures) and over-investment (excess capacity creating high fixed cost burden and chronic

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under-absorption).

Capacity Decision	Financial Analysis Required	Key Assumption Risk	CFO Governance Standard
Add capacity (greenfield or expansion capex)	Revenue opportunity at capacity: incremental revenue × contribution margin ÷ capex + depreciation + incremental fixed operating cost = payback period and IRR; compare to OEE improvement alternative for same capacity gain	Demand forecast accuracy (over-forecast leads to stranded capex with full depreciation burden); cost estimate accuracy; time to production ramp; competitive response if capacity is visible signal to market	Board approval for capex above threshold; demand forecast sensitivity analysis (conservative case payback < 5 years); OEE alternative evaluated; post-investment review at 12 months vs. business case
Improve OEE (operational investment)	Additional throughput value from OEE improvement × contribution margin; cost of improvement program (training, maintenance investment, process redesign); comparison to capex alternative for same capacity	OEE improvement sustainability (is it permanent or does it require ongoing discipline?); cost estimate accuracy; time to achieve improvement target; management attention and change management capacity	CFO approval for improvement investment above threshold; OEE baseline verified before investment; post-program OEE measurement at 6 months; actual vs. projected improvement documented
Reduce capacity (restructuring)	Restructuring cost (severance, facility close, equipment disposal, lease termination): one-time cost vs. annual fixed cost savings; working capital release from reduced inventory; impairment of assets being retired	Demand recovery risk if capacity reduced and demand returns; one-time restructuring cost vs. ongoing savings payback; morale and productivity impact of workforce reduction on remaining staff	Board notification; impairment analysis per ASC 360; restructuring reserve adequacy; disclosure of material restructuring; regulatory requirements for workforce reduction by jurisdiction

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Outsource production (reduce fixed base)	Make cost vs. buy cost comparison including variable cost, fixed cost eliminated, transition cost, quality risk premium, and lead time extension cost; use marginal cost (not full absorption) when existing capacity is already paid	Make cost calculation accuracy (must include only avoidable costs, not sunk costs); buy price sustainability over contract life; quality and IP risk; supply chain single-source risk; management complexity of supplier	Contract review by Legal; transfer pricing documentation for intercompany; quality audit of contract manufacturer; volume commitment financial exposure modeled; exit clause negotiated at contract signing
Flex capacity (overtime or temp labor)	Cost premium of overtime (50% premium on regular rate) or temporary labor (20-50% premium over FTE equivalent); comparison to permanent capacity cost; service level impact of flex vs. permanent capacity	Overtime sustainability (labor laws, fatigue, quality impact at sustained overtime); temporary labor quality and training cost; customer commitment vs. actual throughput with flex capacity model	Overtime policy with approved limits; CFO approval for sustained overtime above defined threshold; temporary labor contract review; customer SLA impact assessment

9. ERP MANUFACTURING CONTROLS: THE FINANCIAL GOVERNANCE ARCHITECTURE

The ERP manufacturing modules — production orders, inventory management, cost accounting, quality management — require specific configuration to enforce the financial controls that make manufacturing financial data reliable. The Systems CFO governs ERP manufacturing configuration as a financial controls design responsibility, not a technical implementation detail. These configurations determine the quality of the audit trail, the reliability of the inventory balance, and the accuracy of the variance analysis — all of which directly affect the reliability of the financial statements.

ERP Manufacturing Control	Financial Control Enforced	Configuration Standard

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Production order authorization	No production can begin without an authorized production order; production order links to BOM and routing for cost accumulation; unauthorized production creates inventory not traceable to a financial commitment	Production order creation requires MPS authorization or manual approval by production supervisor; order cannot be released without valid BOM and routing; partial completion recording requires order to be open in system
Backflushing vs. forward flushing	Backflushing posts material consumption automatically when production is confirmed; forward flushing requires manual pick confirmation; choice affects WIP accuracy and inventory timeliness; each has different audit trail characteristics	Backflushing: simpler but less accurate for WIP; acceptable for low-value, high-volume components; forward flushing: more accurate, better audit trail, required for high-value materials; choose by material classification
Inventory movement controls	All inventory movements (receipt, issue, transfer, adjustment) require authorization; physical count adjustments require Controller approval; no free-text inventory transactions that bypass cost accounting	Approval workflow for inventory adjustments above threshold; segregation of duties: different roles for requesting and approving inventory adjustments; adjustment reason codes required; audit log immutable
Standard cost roll-up controls	Standard cost roll-up (recalculating standard costs when BOM or component prices change) controlled and documented; uncontrolled roll-ups can change COGS mid-period; effective date of new standards governed	Standard cost roll-up run only at approved times; CFO approval required for mid-year interim roll-up; impact on inventory revaluation calculated and disclosed before roll-up executed; prior year standards retained for comparison

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Period-end production close controls	Production orders for completed goods closed at period-end; WIP balances reconciled; variance accounts cleared to COGS; production orders older than production cycle flagged for review	Production order close checklist required; open order WIP reconciled to physical WIP before close sign-off; variance posting to COGS reviewed by Controller; aged production orders require engineering explanation before close

10. MANUFACTURING FINANCIAL KPI ARCHITECTURE

Manufacturing KPI	Definition	Financial Connection	CFO Interpretation
Overall Equipment Effectiveness (OEE)	Availability rate × Performance rate × Quality rate; world-class >85%; typical 60-75%	Each 1pp OEE improvement at $1M/day production value = $3.65M additional annual output capacity without capex; most capital-efficient capacity lever	OEE below 70% on a critical asset warrants OEE improvement program before capex; OEE trend matters as much as absolute level
Manufacturing cost per unit	Total manufacturing cost (material + labor + overhead) ÷ units produced; track vs. standard and trend over time	Direct COGS driver; input to pricing decisions; benchmark for make-vs.-buy; sensitivity: 1% improvement at $10M COGS = $100K annual margin improvement	Decompose into material, labor, overhead components to identify improvement opportunity; compare vs. competitor cost position where available
First Pass Yield (FPY)	Units passing quality inspection on first attempt ÷ total units started; >95% most discrete; >99% high-volume	Scrap and rework cost; warranty reserve driver; each 1pp FPY improvement at $5M material cost = $50K scrap cost reduction	FPY trend is a leading indicator of quality cost; sudden FPY decline signals process problem before it reaches customer complaints

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Schedule adherence	Units produced on schedule ÷ units planned for production; >92% best practice; <85% indicates planning or execution problem	Schedule misses create expediting cost; late delivery creates customer penalty exposure; revenue recognition delayed if delivery-based; MPS credibility affects supply chain planning quality	Chronically low schedule adherence indicates either unrealistic MPS (planning problem) or execution failure (operational problem); root cause determines response
Inventory turns	COGS ÷ average inventory value; industry-specific: 8-15x discrete manufacturing; lower for process industries	Each additional turn on $10M inventory = $1M+ working capital release; at 10% carrying cost = $100K annual savings; turns improvement is the primary manufacturing working capital lever	Decompose turns by inventory category (RM, WIP, FG) to identify where working capital is accumulating; FG turns most sensitive to demand forecast accuracy
Scrap rate (% of COGS)	Scrap cost ÷ COGS; track by material type and production line; best practice <1% of COGS	Direct P&L; cost; every $1 of scrap costs $1 in material plus the labor and overhead embedded in it; scrap rate of 2% on $20M COGS = $400K annual scrap cost	Scrap trend is early warning of quality deterioration; sudden increase in scrap rate warrants immediate root cause investigation before it scales
Overhead absorption rate	Overhead absorbed ÷ overhead incurred; near 100% at normal capacity; chronic under-absorption signals volume below normal capacity	Under-absorption is a current-period P&L; charge; 5% under-absorption at $2M annual fixed overhead = $100K period charge; over-absorption inflates inventory temporarily	Monitor monthly; chronic under-absorption requires review of normal capacity assumption, demand forecast, or pricing strategy

11. MANUFACTURING FINANCIAL GOVERNANCE SCORECARD

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Manufacturing KPI	Lagging	Industry Average	Top Quartile	World-Class
OEE (Overall Equipment Effectiveness)	Below 55%	60-72%	73-82%	Above 85%
First Pass Yield	Below 90%	91-95%	96-98%	Above 99%
Inventory turns (discrete manufacturing)	Below 5x	6-10x	11-15x	Above 15x
Schedule adherence	Below 82%	86-91%	92-96%	Above 97%
Scrap as % of COGS	Above 3%	1.5-2.5%	0.5-1.5%	Below 0.5%
Rework as % of COGS	Above 2%	0.8-1.8%	0.3-0.8%	Below 0.3%
BOM accuracy rate	Below 92%	93-96%	97-99%	Above 99.5%
Manufacturing cost as % of revenue	Above 60%	45-58%	38-45%	Below 38%

KEY FRAMEWORKS — PART 20: MANUFACTURING SYSTEMS AND MRP II ARCHITECTURE	
■ MRP II Five-Component Architecture	■ BOM Governance Framework (5 Elements)
■ Standard Costing Model (5 Components)	■ Manufacturing Variance Analysis (6)
■ Overhead Absorption Architecture	■ Make-vs.-Buy Framework (5 Factors)
■ Inventory Costing Architecture (4)	■ Capacity Decision Framework (5)
■ ERP Manufacturing Controls (5)	■ Manufacturing KPI Architecture (7)
■ Manufacturing Scorecard (8 Metrics)	■ Overhead Absorption Impact Analysis

EXECUTIVE ACTION CHECKLIST

Manufacturing financial governance for the Systems CFO

Action 1: Audit BOM accuracy for top 20 SKUs by COGS (45 days). Pull the BOM for your top 20 finished goods by COGS value and compare each BOM to actual production records for the last three production runs. For any BOM accuracy below 95%, initiate an immediate remediation program. BOM errors directly cause COGS misstatement at every unit produced — there is no other data quality issue in manufacturing with a more direct and continuous financial statement impact.

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Action 2: Analyze all six variance categories for the prior quarter (30 days). Produce a variance analysis report covering all six variance types (MPV, MUV, LEV, LRV, variable overhead efficiency, fixed overhead volume). Identify the variance with the largest financial impact. Assign a root cause investigation with a 30-day finding deadline and a specific operational owner for each material variance.

Action 3: Calculate OEE for critical production assets (30 days). Measure OEE for your three highest-throughput production assets. For any asset below 70% OEE with significant throughput value, build the operational improvement ROI case and compare to the capex alternative for the same capacity gain before approving any expansion capital expenditure.

Action 4: Review standard cost update process (30 days). Verify when standard costs were last updated for your top 10 SKUs by revenue. If standards have not been updated in more than 12 months and material costs have changed by more than 5%, initiate an interim standard cost review. Calculate the COGS misstatement from stale standards and assess whether restatement is required.

Action 5: Build a make-vs.-buy analysis for top 10 externally sourced components (60 days). For your ten largest purchased components by spend, conduct a five-factor make-vs.-buy analysis using the framework in Section 6. Use marginal cost (not full absorption cost) for the internal make cost when existing capacity is available. Identify any components where internal manufacturing would generate better economics at current production volumes.

Action 6: Implement monthly overhead absorption monitoring (30 days). Build a monthly overhead absorption report showing: budgeted fixed overhead, absorbed overhead (rate × actual activity), and over/under absorption amount and percentage. If under-absorption exceeds 10% for two consecutive periods, investigate whether the normal capacity assumption requires revision and assess the pricing implications of structural under-absorption.

BOOK REFERENCES AND FURTHER READING

REFERENCED WORK

ERP Implementation and Business Architecture: Systems Approach for Design and Deployment (Datta, 2026)

The manufacturing systems chapters provide the implementation depth for MRP II configuration, BOM management, standard costing setup, variance analysis configuration, and shop floor control integration with the financial modules. The author's direct manufacturing ERP implementation experience across discrete manufacturing, process manufacturing, and mixed-mode environments informs the practical governance standards.

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REFERENCED WORK

Beyond Linear Finance: Complexity Science and the New Strategic CFO (Datta, 2026)

Chapter 9 (Supply Chains, Networks, and Fragility) provides the complexity science lens for manufacturing systems — particularly the nonlinear behavior of production systems under demand variability (the bullwhip effect), the resilience architecture required for manufacturing enterprises, and the systems dynamics of inventory accumulation and depletion cycles that the MRP II system must manage.

REFERENCED WORK

The System Level CFO: Leading Through Complexity, Culture, and Capital (Datta, 2026)

Chapter 8 (Working Capital as Flow Physics) connects manufacturing inventory management to the working capital optimization framework — treating inventory as a flow variable governed by production rate, demand rate, and the quality of the demand planning system. The chapter develops the financial analysis for inventory investment decisions that connects standard costing and overhead absorption to working capital strategy.

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