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Bachelor of Commerce (B2001) | Year 1 • Part A Core | Monash University

Accounting fundamentals

Course Code: ACC1001 • Module 2 Notes

Module 2: Cost Behaviour, Cost-Volume-Profit Analysis & Performance Measurement

2.1 Cost Concepts, Cost Objects, and Cost Classifications

While financial accounting reports aggregate historical costs to external stakeholders, managers require disaggregated cost intelligence to price products, manage capacity, evaluate customer profitability, and control departmental spending. A **cost** is an economic sacrifice of resources, measured in monetary terms, incurred or potentially to be incurred to achieve a specific objective. To organise cost data meaningfully, management accountants assign costs to a **cost object**—any item, activity, or organisational unit for which a separate cost measurement is desired, such as a manufactured product, a hospital clinical procedure, a retail store, a delivery route, or an environmental compliance program.

Because different managerial decisions demand different views of cost, accounting classifies the same expenditure along multiple analytical dimensions.

Classification Axis	Categories	Managerial Purpose & Examples
Traceability to Cost Object	Direct Costs vs. Indirect Costs	Direct materials (steel chassis) and direct labour (assembly technicians) are traced economically to units; indirect factory electricity and supervisor salaries are allocated via overhead rates.
Financial Reporting Timing	Product (Inventoriable) Costs vs. Period Costs	Product costs attach to inventory under AASB 102 and become COGS only when sold; period costs (head-office rent, sales commissions, advertising) are expensed immediately in the period incurred.
Behaviour with Activity Volume	Variable Costs vs. Fixed Costs vs. Mixed Costs	Crucial for break-even modelling, flexible budgeting, and short-term capacity decisions within the relevant range.
Decision Relevance	Relevant (Differential) Costs vs. Sunk & Committed Costs	Only future costs that differ across alternatives (avoidable materials, overtime) affect a choice; past sunk outlays (already purchased machinery) are irrelevant to forward decisions.

Manufacturing, Merchandising, and Service Sector Cost Structures

In Australian manufacturing firms, product costs combine **direct materials**, **direct labour**, and **manufacturing overhead** (indirect materials, indirect labour, factory depreciation, and plant utilities). Direct materials and direct labour together form *prime costs*, whereas direct labour and manufacturing overhead form *conversion costs* required to transform raw inputs into finished goods. By contrast, retail and wholesale merchandisers hold finished merchandise inventory whose inventoriable cost consists of purchase price plus inward freight and customs duties, while service enterprises—such as accounting practices, airlines, and cloud software providers—carry negligible physical inventory and manage predominantly labour-intensive and fixed-infrastructure cost structures.

When making forward-looking choices, managers must also distinguish **opportunity costs**—the net contribution foregone by rejecting the next-best alternative use of a scarce resource—from out-of-pocket cash outlays. Although opportunity costs never appear in historical general ledger accounts, ignoring them

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leads to suboptimal capacity allocation.

Overhead Allocation, Predetermined Overhead Rates, and Activity-Based Costing (ABC)

While direct materials and direct labour trace smoothly to individual jobs or service engagements, indirect overheads (factory power, plant depreciation, engineering support) must be assigned systematically using an allocation base. Traditional costing systems calculate an annual **Predetermined Overhead Rate (POHR)** prior to the period using budgeted data to avoid seasonal cost swings:

$$POHR = \frac{\text{Budgeted Annual Overhead Costs}}{\text{Budgeted Annual Cost-Driver Volume}}$$

Where:

- $POHR$ = Predetermined Overhead Rate (dollars of overhead applied per unit of allocation base)
- $extBudgetedAnnualCost - DriverVolume$ = Expected machine hours, direct labour hours, or direct labour dollars

When an enterprise manufactures diverse products—some high-volume standardised items and others low-volume, custom-engineered batches requiring frequent machine setups and quality inspections—a single plantwide POHR severely cross-subsidises complex low-volume items at the expense of simple high-volume lines. **Activity-Based Costing (ABC)** resolves this distortion by pooling overhead into distinct activity cost pools across four hierarchical levels: *unit-level* activities (performed for every unit, such as power), *batch-level* activities (performed per production run, such as machine setups and purchase orders), *product-sustaining* activities (engineering design changes), and *facility-sustaining* activities (factory rates and security).

Costing System Feature	Traditional Volume-Based Costing	Activity-Based Costing (ABC)
Cost Pools	Single plantwide pool or small number of departmental pools.	Multiple granular activity pools (setup, inspection, procurement, machining).
Allocation Drivers	Exclusively volume-based (direct labour hours, machine hours, units).	Cause-and-effect transaction and duration drivers (number of setups, orders, inspections).
Strategic Accuracy	Overcosts high-volume simple products and undercosts low-volume complex products.	Accurate product and customer profitability visibility; higher implementation cost.

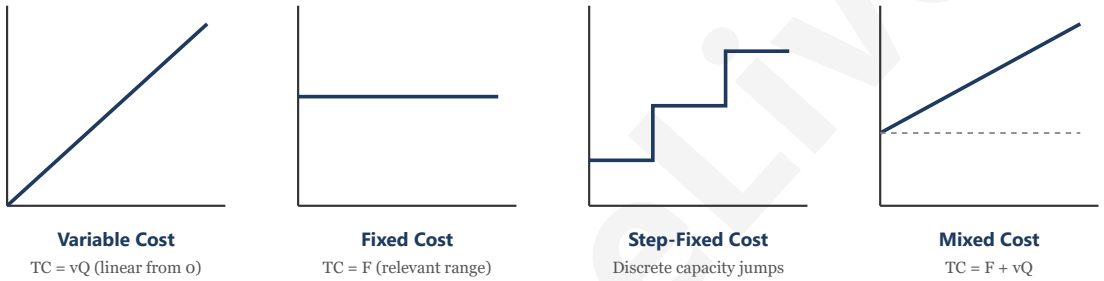
2.2 Cost Behaviour Patterns and Cost Estimation

Cost behaviour describes how total cost and unit cost respond to changes in an underlying **cost driver** (such as units produced, machine hours, billable consulting hours, or kilometres driven) within a bounded operating band known as the **relevant range**. The relevant range represents the span of activity over which existing physical capacity and cost relationships remain valid without acquiring additional plant or downsizing core infrastructure.

- **Variable Costs:** Total variable cost changes in direct proportion to activity volume, while variable cost per unit remains constant within the relevant range. Examples include raw packaging per bottle, sales

commissions at 5% of revenue, and freight charges per carton.

- **Fixed Costs:** Total fixed cost remains constant across changes in activity volume within the relevant range, causing fixed cost per unit to fall as volume spreads overhead across more units. Fixed costs are further divided into *committed fixed costs* (long-term lease obligations, depreciation of automated equipment, property rates) that cannot be cut quickly without harming capacity, and *discretionary fixed costs* (annual staff training, research grants, brand advertising) adjusted annually by management.
- **Step-Fixed Costs:** Costs that remain constant across narrow activity intervals but jump discretely once capacity thresholds are crossed—for instance, hiring one additional quality-control inspector for every 2,500 units produced.
- **Mixed (Semi-Variable) Costs:** Costs containing both a fixed base component and a variable usage component, such as commercial electricity tariffs (fixed daily supply charge plus per-kilowatt-hour usage charge) or delivery fleet expenses (fixed vehicle lease plus fuel per kilometre).



The Linear Cost Function and High-Low Cost Estimation

Mixed costs must be separated into their fixed and variable elements before managers can forecast costs at new activity levels or conduct break-even planning. The standard linear cost model is expressed as:

$$TC = F + vQ$$

Where:

- TC = Total mixed cost for the period (in dollars)
- F = Fixed cost component per period (vertical intercept)
- v = Variable cost per unit of the cost driver (slope)
- Q = Volume of the cost driver (activity level in units, hours, or kilometres)

Under the **High-Low Method**, an analyst identifies the observations with the highest and lowest activity levels (Q_{high} and Q_{low}—never the highest and lowest dollar costs if they occur at different months) and computes the slope between those two points:

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$$v = \frac{TC_{\text{high}} - TC_{\text{low}}}{Q_{\text{high}} - Q_{\text{low}}}, \qquad F = TC_{\text{high}} - vQ_{\text{high}}$$

Where:

- $TC_{\text{high}}, TC_{\text{low}}$ = Total costs observed at the highest and lowest activity levels respectively
- $Q_{\text{high}}, Q_{\text{low}}$ = Highest and lowest observed activity volumes within the relevant range

While rapid and transparent, the high-low method relies exclusively on two data points; if either extreme month reflects an abnormal weather spike or equipment breakdown, the resulting cost line will be biased. Accordingly, managers inspect scattergraphs first to verify linearity and, where multi-period historical data are available, apply *ordinary least-squares (OLS) regression* to minimise squared prediction errors across all observations.

Worked Numerical Example: High-Low Cost Estimation (AUD)

Geelong Cold Chain Logistics Pty Ltd operates refrigerated trucks transporting Victorian dairy exports. Fleet maintenance and cooling energy records over six months in 2026 are shown below:

Month	Refrigerated Kilometres (Q)	Total Fleet Cost (TC, A$)
January	42,000	$98,400
February	38,000	$91,600
March	54,000	$118,800
April	32,000	$81,400
May	48,000	$109,200
June	45,000	$104,100

Step 1 — Select High and Low Activity Points: Highest activity occurred in March ($Q_{\text{high}} = 54,000$ km, $TC_{\text{high}} =$ $118,800). Lowest activity occurred in April ($Q_{\text{low}} = 32,000$ km, $TC_{\text{low}} =$ $81,400).

Step 2 — Calculate Variable Cost per Kilometre (v):

$$v = \frac{118,800 - 81,400}{54,000 - 32,000} = \frac{37,400}{22,000} = \$1.70 \text{ per km}$$

Step 3 — Solve for Monthly Fixed Cost (F):

$$F = 118,800 - (1.70 \times 54,000) = 118,800 - 91,800 = \$27,000 \text{ per month}$$

Cross-checking at April's low volume confirms $F = 81,400 - (1.70 \times 32,000) = 81,400 - 54,400 = \$27{,}000$. Thus, the estimated cost function is $TC = 27,000 + 1.70Q$.

Step 4 — Forecast July Cost at 50,000 km: Substituting $Q = 50,000$ gives $TC = 27,000 + (1.70 \times 50,000) = \$112{,}000$.

Regression Diagnostics, Engineering Estimation, and Learning Curves

When historical data span 24 or more periods, managers replace the two-point high-low shortcut with **ordinary least-squares (OLS) regression**, which estimates the intercept (F) and slope (v) across all observations simultaneously. Three statistical diagnostics govern whether a regression cost equation is fit for budgeting:

- **Coefficient of Determination (R^2):** Measures the proportion of total cost variance explained by the chosen cost driver (ranging from 0 to 1.0). An R^2 above 0.75 signals strong explanatory power; low R^2 warns that other omitted cost drivers (such as number of product changeovers or ambient temperature) dominate spending.
- **Statistical Significance (p-value and t-statistic):** Confirms that the slope coefficient v differs reliably from zero ($p < 0.05$) rather than reflecting random noise.
- **Economic Plausibility & Relevant Range Discipline:** Even a high R^2 cannot justify extrapolating a linear cost equation outside observed capacity bounds, because economies of scale, overtime wage penalties, and *learning-curve effects* (where cumulative doubling of output reduces unit assembly labour time by a constant percentage) introduce non-linearity at extreme volumes.

For newly launched facilities or greenfield renewable-energy projects lacking historical accounting records, management accountants partner with industrial engineers under the **engineering method**—conducting time-and-motion studies, analysing bills of materials, and benchmarking equipment power ratings to construct bottom-up cost functions.

2.3 Cost-Volume-Profit (CVP) Analysis and Break-Even Modelling

Cost-Volume-Profit (CVP) analysis examines how operating profit responds to systematic shifts in selling price, unit variable cost, sales volume, fixed cost structure, and product mix. Built upon the contribution margin format of the income statement, CVP modelling provides a rapid strategic lens for pricing, launch feasibility, and risk evaluation.

Standard single-period CVP analysis rests on five explicit assumptions: (1) all costs can be cleanly separated into fixed and variable elements; (2) total revenue and total cost behave linearly within the relevant range; (3) selling price per unit, unit variable cost, and total fixed costs remain constant over the planning period; (4) production volume equals sales volume (no change in finished goods inventory); and (5) in multi-product settings, the sales mix remains constant.

Contribution Margin, Break-Even Point, and Target Profit

Contribution Margin (CM) represents the amount remaining from sales revenue after deducting variable costs that is available first to cover fixed costs and subsequently to generate operating profit:

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$$CM_{\text{unit}} = P - v, \qquad CMR = \frac{P - v}{P}$$

Where:

- CM_{unit} = Unit Contribution Margin (dollars earned per unit sold above variable cost)
- P = Selling price per unit
- v = Total variable cost per unit (manufacturing plus variable selling/administrative costs)
- CMR = Contribution Margin Ratio (proportion of each sales dollar available to cover fixed costs and profit)

At the **Break-Even Point (BEP)**, total sales revenue equals total costs so operating profit (EBIT) is exactly zero. Setting $(P - v)Q - F = 0$ yields the break-even volume in units and sales dollars:

$$Q_{BE} = \frac{F}{P - v} = \frac{F}{CM_{\text{unit}}}, \qquad S_{BE} = \frac{F}{CMR}$$

Where:

- Q_{BE} = Break-even sales quantity in physical units
- S_{BE} = Break-even sales revenue in dollars
- F = Total fixed costs for the period

Managers frequently target a specific pre-tax profit ($P i_{\text{pre}}$) or after-tax profit ($P i_{\text{after}}$). Under Australia's corporate income tax regime, pre-tax profit required to deliver an after-tax target equals $P i_{\text{after}}/(1 - t)$, where t is the applicable corporate tax rate (typically 30% for general companies or 25% for qualifying base rate entities):

$$Q_{\text{target}} = \frac{F + \frac{\Pi_{\text{after}}}{1 - t}}{P - v}$$

Where:

- Q_{target} = Sales units required to achieve the after-tax profit goal
- $P i_{\text{after}}$ = Target Net Profit After Tax
- t = Corporate income tax rate (expressed as a decimal, e.g., 0.30)

Margin of Safety and Operating Leverage

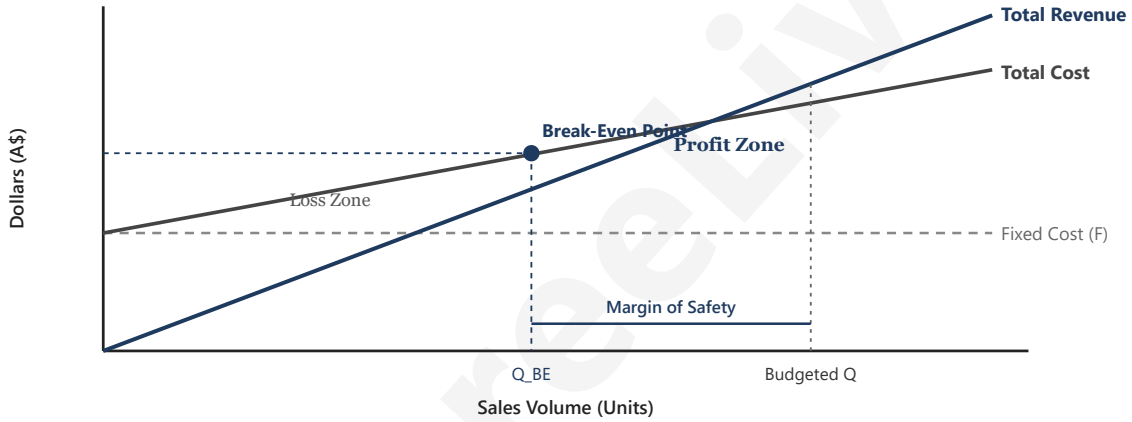
Two complementary risk measures extend CVP insight beyond the break-even threshold. The **Margin of Safety (MOS)** measures how far actual or budgeted sales exceed break-even sales before losses occur, whereas the **Degree of Operating Leverage (DOL)** measures earnings sensitivity to percentage changes in revenue driven by fixed costs:

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$$MOS\% = \frac{S - S_{BE}}{S} \times 100\%, \qquad DOL = \frac{CM_{\text{total}}}{\Pi_{\text{pre}}}$$

Where:

- $MOS\%$ = Margin of Safety percentage (maximum percentage revenue drop tolerated before incurring an operating loss)
- S = Actual or budgeted total sales revenue
- DOL = Degree of Operating Leverage (percentage change in EBIT resulting from a 1% change in sales revenue)
- CM_{total} = Total contribution margin at current sales volume
- $P\,i_{\text{pre}}$ = Operating profit (EBIT) at current sales volume



Worked Numerical Example 1: Single-Product CVP Analysis (AUD)

Tasman Artisan Breweries Pty Ltd produces craft ginger beer in 24-bottle cartons. Each carton sells for $60.00. Variable manufacturing cost is $26.00 per carton and variable distribution cost is $4.00 per carton. Annual fixed costs (brewery lease, depreciation, and salaried brewers) total $450,000. Current budgeted volume is 20,000 cartons per year, and the company faces a 30% Australian corporate tax rate.

1. **Unit Contribution Margin and CMR:** Total variable cost per carton is $v = \$26 + \$4 = \$30.00$. Thus $CM_{\text{unit}} = \$60 - \$30 = \$30.00$, and $CMR = 30/60 = 0.50$ (50%).
2. **Break-Even Point:** $Q_{BE} = 450,000/30 = 15,000$ cartons. In sales dollars, $S_{BE} = 450,000/0.50 = \$900,000$ (verified: 15,000 × $60 = $900,000).
3. **Target After-Tax Profit of $210,000:** Pre-tax operating profit required is $210,000 / (1 – 0.30) = $300,000. Required sales volume is $Q_{\text{target}} = (450,000 + 300,000)/30 = 25,000$ cartons ($1,500,000 in sales).
4. **Margin of Safety and Operating Leverage at Budget (20,000 cartons):** Budgeted sales equal 20,000 × $60 = $1,200,000. Margin of Safety in dollars is $1,200,000 – $900,000 = $300,000, or $MOS\% = (300,000/1,200,000) \times 100\% = 25.0\%$. Total contribution margin is 20,000 × $30 = $600,000, yielding EBIT of $600,000 – $450,000 = $150,000. Consequently, $DOL =$

$600,000/150,000 = 4.00$. If sales volume rises by 10% (to 22,000 cartons), EBIT will surge by 10% × 4.00 = 40% (from $150,000 to $210,000). Conversely, a 10% revenue drop cuts EBIT by 40%.

Multi-Product CVP Analysis and Worked Example 2

Most enterprises sell multiple products with distinct contribution margins. Multi-product CVP models assume a constant physical sales mix (w_i) and compute a **weighted-average contribution margin (CM_w)**:

$$CM_w = \sum_{i=1}^{k} w_i \cdot CM_i, \qquad Q_{BE,\text{total}} = \frac{F}{CM_w}$$

Where:

- w_i = Proportion of total unit sales represented by product i (where $sum w_i = 1$)
- CM_i = Unit contribution margin of product i
- $Q_{BE,\text{total}}$ = Combined break-even unit volume across all products

Worked Example — Adelaide Solar Solutions Pty Ltd: The firm installs two battery-inverter packages with annual fixed overheads of $660,000. Residential packages sell for $8,000 (variable cost $5,500; $CM = \$2{,}500$) and represent 75% of unit installations ($w_1 = 0.75$). Commercial packages sell for $22,000 (variable cost $15,000; $CM = \$7{,}000$) and represent 25% of installations ($w_2 = 0.25$).

First, compute weighted-average contribution margin: $CM_w = (0.75 \times 2{,}500) + (0.25 \times 7{,}000) = 1{,}875 + 1{,}750 = \$3{,}625$ per composite unit. Second, total break-even installations equal $Q_{BE,\text{total}} = 660{,}000/3{,}625 = 182.07 \approx 183$ composite installations (specifically, 182.07 × 0.75 ≈ 137 residential units and 182.07 × 0.25 ≈ 46 commercial units). Note that if demand shifts unexpectedly toward lower-margin residential units, CM_w declines and the total break-even volume rises.

Cost Structure Trade-Offs and Indifference Point Analysis

Strategic capacity planning frequently involves choosing between a labour-intensive cost structure (low fixed cost F_A, high unit variable cost v_A) and a highly automated cost structure (high fixed cost F_B, low unit variable cost v_B). Comparing operating profits across alternatives identifies the **cost indifference point (Q^*)**—the exact sales volume where both cost structures yield identical total cost and identical operating profit:

$$F_A + v_A Q^* = F_B + v_B Q^* \implies Q^* = \frac{F_B - F_A}{v_A - v_B}$$

Where:

- Q^* = Indifference sales/production volume in physical units
- F_A, F_B = Annual fixed costs of Option A (manual) and Option B (automated) respectively
- v_A, v_B = Unit variable costs of Option A and Option B respectively

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Worked Example — Packaging Line Automation: A Melbourne food packer compares retaining manual packing (F_A = \$180,000, v_A = \$6.50/unit) against leasing semi-automated robotics (F_B = \$390,000, v_B = \$3.00/unit). The indifference volume equals $Q^* = (390,000 - 180,000)/(6.50 - 3.00) = 210,000/3.50 = 60,000$ units/year. Above 60,000 units, automation yields higher profit and higher operating leverage; below 60,000 units, the manual option preserves downside flexibility and carries lower break-even risk.

2.4 Short-Term Managerial Decisions Using Relevant Costing

Short-term tactical choices—accepting a discounted one-off order, outsourcing a component, dropping an underperforming retail store, or allocating scarce machine hours—rely on **relevant costing** (also termed differential or incremental analysis). An item of revenue or cost is relevant only if it satisfies two strict criteria: it occurs in the *future*, and it *differs* between the alternatives under consideration. Historical outlays (sunk costs) and unavoidable fixed overheads that continue regardless of the choice must be excluded.

Decision Context	Relevant Financial Criterion	Key Qualitative & Strategic Considerations
Special Order Pricing	Accept if incremental revenue exceeds incremental variable costs plus any avoidable setup costs and opportunity cost of displaced regular sales.	Risk of price erosion if regular domestic customers demand matching discounts; brand positioning.
Make-or-Buy (Outsourcing)	Compare external supplier price against internal avoidable variable costs and avoidable fixed supervisory/lease costs.	Supplier reliability, quality assurance, intellectual property protection, and domestic workforce morale.
Constrained Resource Mix	Rank products by **Contribution Margin per unit of the bottleneck resource** (not per product unit).	Maintaining full-line customer bundles, bottleneck expansion feasibility, and SLA penalties.
Keep-or-Drop Segment	Retain if segment contribution margin exceeds avoidable segment-specific fixed costs (ignore allocated corporate head-office overheads).	Cross-selling spillover effects (loss-leader items driving store foot traffic).

Worked Numerical Example: Bottleneck Resource Allocation & Special Order

A Melbourne precision medical component manufacturer operates an automated CNC milling centre capped at 4,000 machine hours per quarter. Existing regular demand requires all available capacity across two products:

- **Valve Housing (VH-10):** Selling price \$180; variable cost \$100; unit CM = \$80; CNC time required = 2.0 machine hours per unit; quarterly market demand = 1,200 units (2,400 hours).
- **Sensor Bracket (SB-20):** Selling price \$135; variable cost \$75; unit CM = \$60; CNC time required = 1.0 machine hour per unit; quarterly market demand = 2,200 units (2,200 hours).

Optimal Mix Calculation: Total demand needs 2,400 + 2,200 = 4,600 hours, exceeding the 4,000-hour ceiling. Comparing unit CM (\$80 vs. \$60) is misleading because VH-10 consumes twice the bottleneck time. Computing contribution margin per bottleneck hour yields:

- VH-10: \$80 / 2.0 hours = \$40.00 per machine hour.

- SB-20: $60 / 1.0 hour = $60.00 per machine hour.

Management should therefore allocate capacity first to full demand for SB-20 (2,200 units × 1.0 hr = 2,200 hours, generating $132,000 CM), leaving 4,000 − 2,200 = 1,800 hours for VH-10 (1,800 / 2.0 = 900 units, generating $72,000 CM). Maximum total contribution margin is $204,000.

Special Order Evaluation at Full Capacity: Suppose an interstate hospital group requests a one-off special order for 100 units of a custom bracket requiring 1.5 machine hours each (150 hours total) and variable manufacturing cost of $70 per unit. Because the plant operates at full capacity, accepting the order forces management to displace 150 hours of the lowest-ranking regular product (VH-10), sacrificing 150 × $40 = $6,000 of contribution margin ($40/hr opportunity cost). Therefore, the minimum acceptable special-order price per unit is variable cost ($70) plus opportunity cost ($6,000 / 100 = $60) = $130 per unit.

Customer Profitability Analysis

Relevant costing and activity-based thinking extend beyond products to individual customers. Two accounts generating identical annual sales revenue and identical product gross margins can exhibit radically different net operating profitability once *cost-to-serve* expenses—expedited air freight, small frequent order processing, custom labelling, extended debtor days, and high product return rates—are traced to customer tiers. Empirical studies frequently reveal a "whale curve" in which the most profitable 20% of customers generate over 150% of total operating profit, the middle 60% break roughly even, and the bottom 20% erode substantial value. Rather than immediately dropping unprofitable customers, managers convert them to profitability by introducing minimum order quantities, charging rush-delivery surcharges, migrating routine ordering to self-service portals, or unbundling technical support fees.

2.5 Responsibility Accounting, Decentralisation, and Divisional Performance Measurement

As Australian organisations expand across states, product lines, and customer segments, senior executives decentralise operational authority to divisional managers who possess superior local market knowledge and can respond rapidly to competitors. However, decentralisation creates a coordination risk: divisional managers may pursue local metrics in ways that undermine enterprise-wide value (lack of **goal congruence**). **Responsibility accounting** addresses this challenge by matching accountability with decision rights—holding managers responsible solely for revenues, costs, and assets they can substantially control.

Responsibility Centre	Managerial Decision Authority	Primary Financial Performance Metric
Cost Centre	Controls input usage and operational spending, not pricing or sales volume (e.g., manufacturing plant, IT helpdesk).	Flexible budget cost variances and unit cost efficiency.
Revenue Centre	Controls sales volume and customer mix within pricing rules, not production costs (e.g., regional sales branch).	Sales revenue variance and market share growth.

Responsibility Centre	Managerial Decision Authority	Primary Financial Performance Metric
Profit Centre	Controls both revenue generation and operating costs, not major capital expenditure (e.g., retail store division).	Divisional segment margin and controllable EBIT.
Investment Centre	Controls revenues, operating costs, AND invested working capital and property, plant, and equipment (e.g., autonomous subsidiary).	Return on Investment (ROI), Residual Income (RI), and Economic Value Added (EVA).

Investment Centre Metrics: ROI (DuPont) and Residual Income

Evaluating an investment centre purely on absolute dollar profit ignores the capital tied up to earn that profit. Two core financial metrics scale profit against invested capital: **Return on Investment (ROI)** and **Residual Income (RI)**.

$$ROI = \frac{\text{Divisional EBIT}}{\text{Average Invested Capital}} = \underbrace{\frac{\text{Divisional EBIT}}{\text{Sales}}}_{\text{Profit Margin}} \times \underbrace{\frac{\text{Sales}}{\text{Average Invested Capital}}}_{\text{Asset Turnover}}$$

Where:

- ROI = Return on Investment (percentage return earned per dollar of capital deployed)
- $extDivisionalEBIT$ = Controllable operating profit before interest and corporate taxes
- $extAverageInvestedCapital$ = Mean of opening and closing divisional total assets (or net operating assets)

Decomposing ROI via the **DuPont formula** reveals two distinct managerial levers: improving operating *Profit Margin* (through pricing power or cost control) and accelerating *Asset Turnover* (generating higher revenue per dollar of inventory, receivables, and equipment). Despite its popularity, ROI suffers from a severe behavioural flaw: a high-performing division earning 22% ROI may reject an attractive expansion project earning 15% ROI—even when the firm's cost of capital is 10%—because adding a 15% project lowers the division's average ROI.

Residual Income (RI) eliminates this sub-optimal rejection bias by measuring dollar profit earned *above* a minimum capital charge:

$$RI = \text{Divisional EBIT} - (r \times \text{Average Invested Capital})$$

Where:

- RI = Residual Income (economic profit in dollars above the required capital charge)
- r = Corporate required rate of return (weighted average cost of capital, WACC)

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Under RI, any project earning more than the required rate r generates positive RI and increases both the divisional manager's score and shareholder wealth, restoring goal congruence. Note that RI is an absolute dollar measure, making direct size comparisons between a large division and a small division inappropriate unless paired with ROI.

Worked Numerical Example: ROI vs. Residual Income in Capital Allocation

Pacific Retail Group Ltd evaluates two autonomous divisions against a corporate required rate of return (r) of 10%. Current divisional data are:

- **East Coast Division:** Sales $12,000,000; Divisional EBIT $1,440,000; Average Invested Capital $6,000,000.
- **Western Division:** Sales $8,000,000; Divisional EBIT $640,000; Average Invested Capital $8,000,000.

Baseline Metrics:

- East Coast ROI = $1,440,000 / $6,000,000 = 24.0% (Margin = $1,440,000 / $12,000,000 = 12.0%; Turnover = $12,000,000 / $6,000,000 = 2.00x). Baseline RI = $1,440,000 – (0.10 × $6,000,000) = $840,000.
- Western ROI = $640,000 / $8,000,000 = 8.0% (Margin = 8.0%; Turnover = 1.00x). Baseline RI = $640,000 – (0.10 × $8,000,000) = –$160,000 (destroying economic value below the 10% hurdle).

Evaluating a New $1,000,000 Automated Warehouse Project: Suppose a new warehouse automation upgrade costing $1,000,000 is available to East Coast Division, generating $160,000 in annual EBIT (a 16.0% standalone return, clearly exceeding the 10% WACC). If evaluated solely by ROI, East Coast's revised ROI falls from 24.0% to ($1,440,000 + $160,000) / ($6,000,000 + $1,000,000) = $1,600,000 / $7,000,000 = 22.86%, incentivising the East Coast manager to reject a value-creating investment. Under Residual Income, however, East Coast's RI increases by $160,000 – (0.10 × $1,000,000) = +$60,000 (rising from $840,000 to $900,000), aligning divisional incentives with corporate value creation.

The Balanced Scorecard: Integrating Financial and Non-Financial KPIs

Because ROI and RI remain short-term financial indicators vulnerable to under-investment in maintenance, staff training, or customer service, Kaplan and Norton's **Balanced Scorecard** translates corporate strategy into linked objectives and targets across four complementary perspectives:

1. **Financial Perspective:** Lagging outcomes reflecting shareholder value creation (ROI, Residual Income, operating cash flow, revenue growth).
2. **Customer Perspective:** Leading market drivers (Net Promoter Score, customer retention rate, on-time delivery percentage, market share in target segments).
3. **Internal Business Process Perspective:** Operational excellence and sustainability metrics (defect rate, cycle time, inventory turnover, Scope 1 & 2 emissions per unit produced).
4. **Learning and Growth Perspective:** Foundational capabilities driving future competitiveness (employee retention, training hours per staff member, safety incident frequency, digital system uptime).

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By linking cause-and-effect relationships across all four quadrants—for example, investing in technician training (Learning & Growth) to reduce rework (Internal Process), improve client retention (Customer), and lift Residual Income (Financial)—managers avoid sacrificing long-term strategic capability for quarterly earnings targets.

Transfer Pricing in Decentralised Corporate Groups

When one autonomous division within an Australian corporate group supplies intermediate goods or shared services to another division (for instance, a Western Australian mining-equipment foundry supplying castings to a Queensland assembly division), the internal transaction price—the **transfer price**—becomes revenue for the selling division and an input cost for the buying division. While transfer prices cancel out in consolidated group financial statements, they directly alter each manager's reported EBIT, ROI, and Residual Income.

To preserve divisional autonomy while guaranteeing goal congruence, management accounting establishes the **general transfer-pricing rule**:

> $$TP_{\min} = \text{Incremental Outlay Cost per Unit} + \text{Opportunity Cost per Unit to Selling Division}$$

Where:

- TP_{min} = Minimum acceptable internal transfer price from the corporate group's perspective
- $extIncrementalOutlayCost$ = Variable manufacturing and internal transfer costs incurred by the selling division
- $extOpportunityCost$ = Foregone external contribution margin per unit if the selling division operates at full capacity (zero if the selling division holds idle spare capacity)

If the selling division has idle capacity, TP_{min} equals variable outlay cost; any internal transfer below the external supplier's quote (TP_{max}) benefits both divisions and the group. At full capacity, TP_{min} equals the external market price (minus avoidable external selling commissions), preventing value-destroying internal diversions. Where transfers cross international borders (for example, between an Australian subsidiary and a Singapore distribution hub), the Australian Taxation Office (ATO) strictly enforces *arm's-length pricing* under Division 815 of the *Income Tax Assessment Act 1997 (Cth)* to prevent cross-border profit shifting.

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