CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

MODULE 1: SUPPLY CHAINS AND STRATEGY

APICS

ASCM

Module 1 Overview

Supply Chains and Strategy

- **Section A:** Supply Chains, the Environment, and Strategy
- **Section B:** Strategic Scope and Objectives
- **Section C:** Developing and Managing Organizational Strategy
- **Section D:** Functional and Operational Strategies
- **Section E:** Environments, Types, and Layouts
- **Section F:** Performance Monitoring and KPIs
- **Section G:** Risk Management
- **Section H:** Capital Equipment and Facilities
- **Section I:** Sustainability Strategies

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION A:
SUPPLY CHAINS, THE ENVIRONMENT, AND STRATEGY

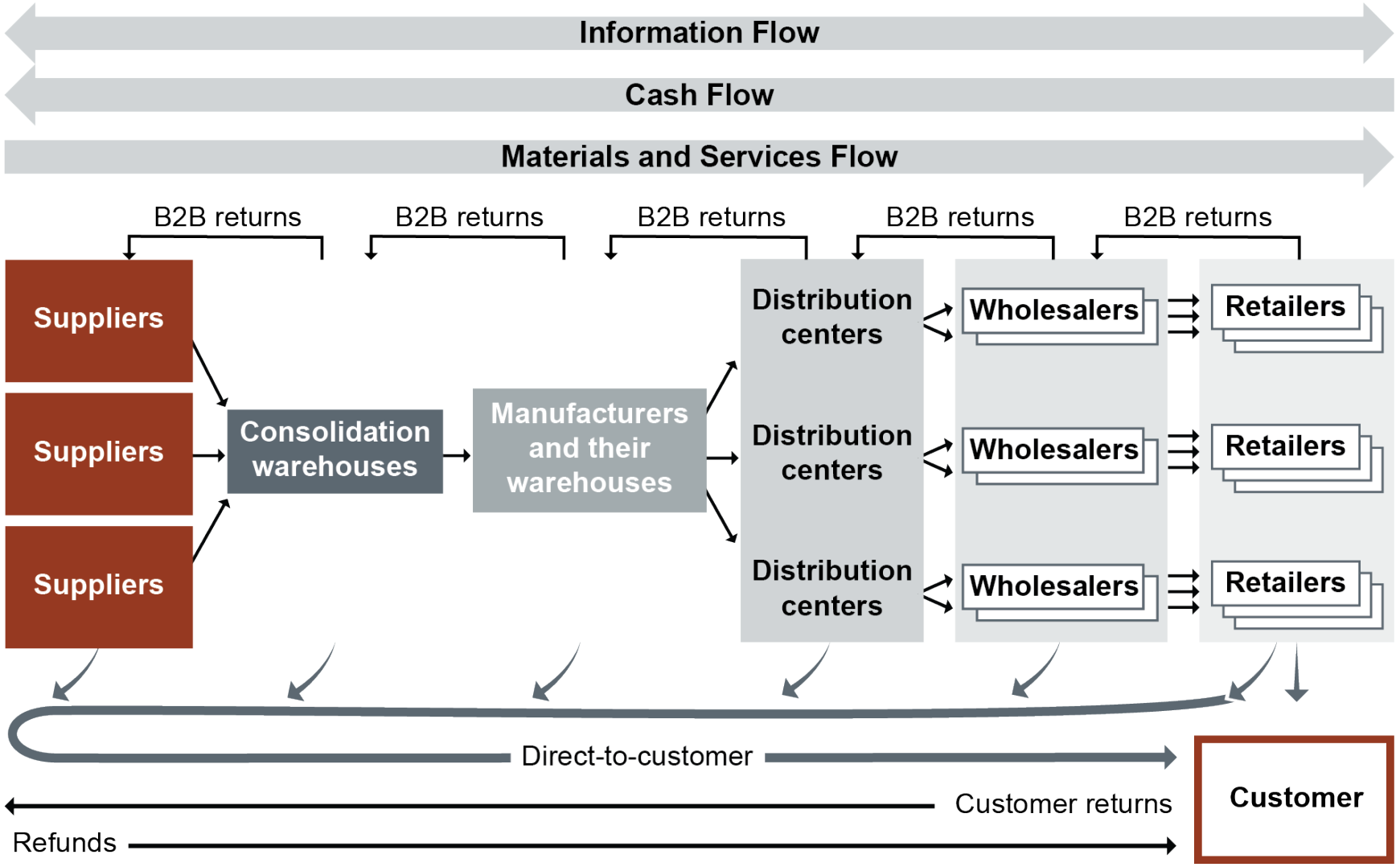
APICS

ASCM

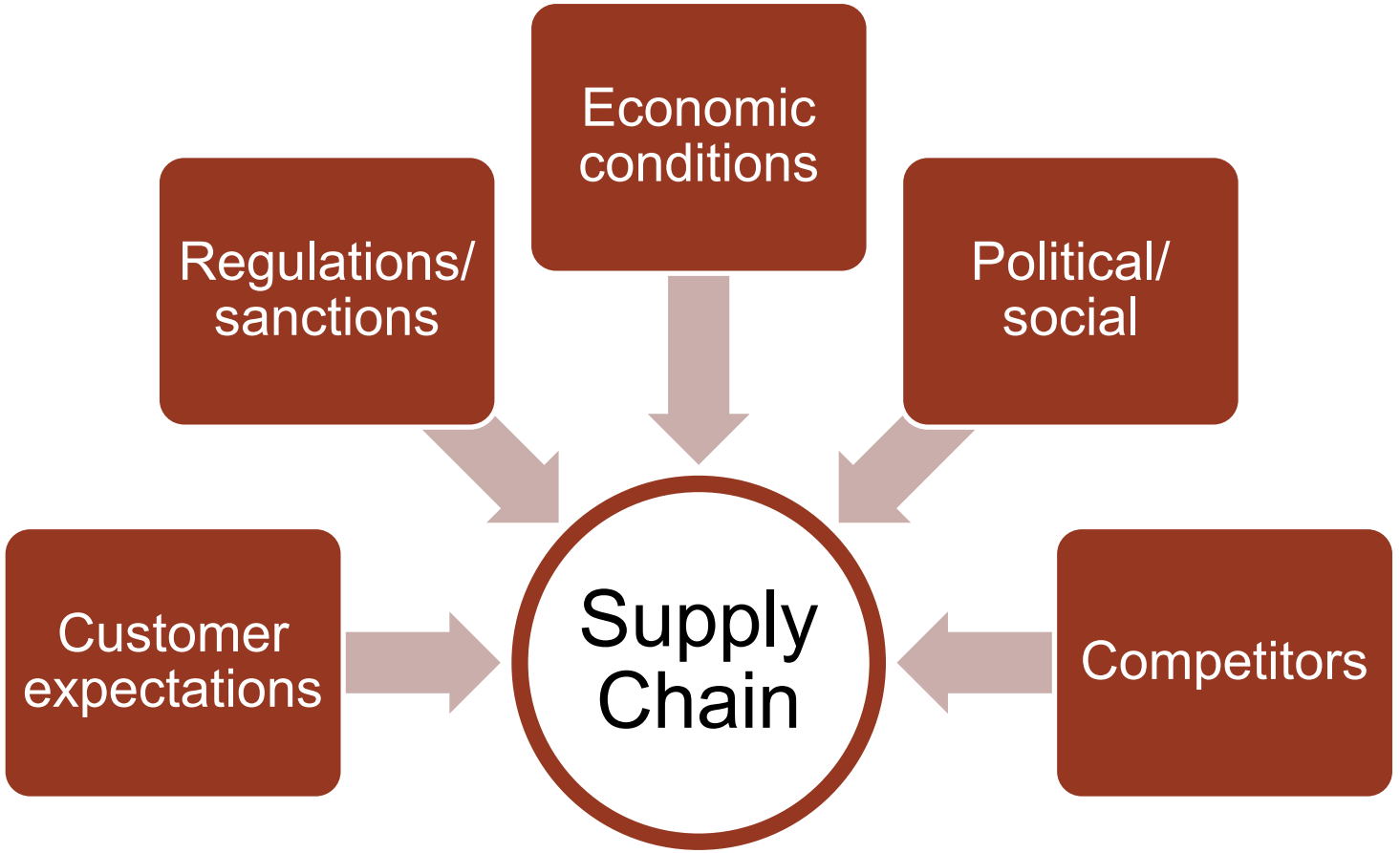
Section A Learning Objectives

- How manufacturing fits in the supply chain
- Business vision, mission, values, and strategy
- Critical requirements for successful business strategies
- Process used in strategic planning and management
- Levels of strategy
- Tools used to understand organization's internal and external environments

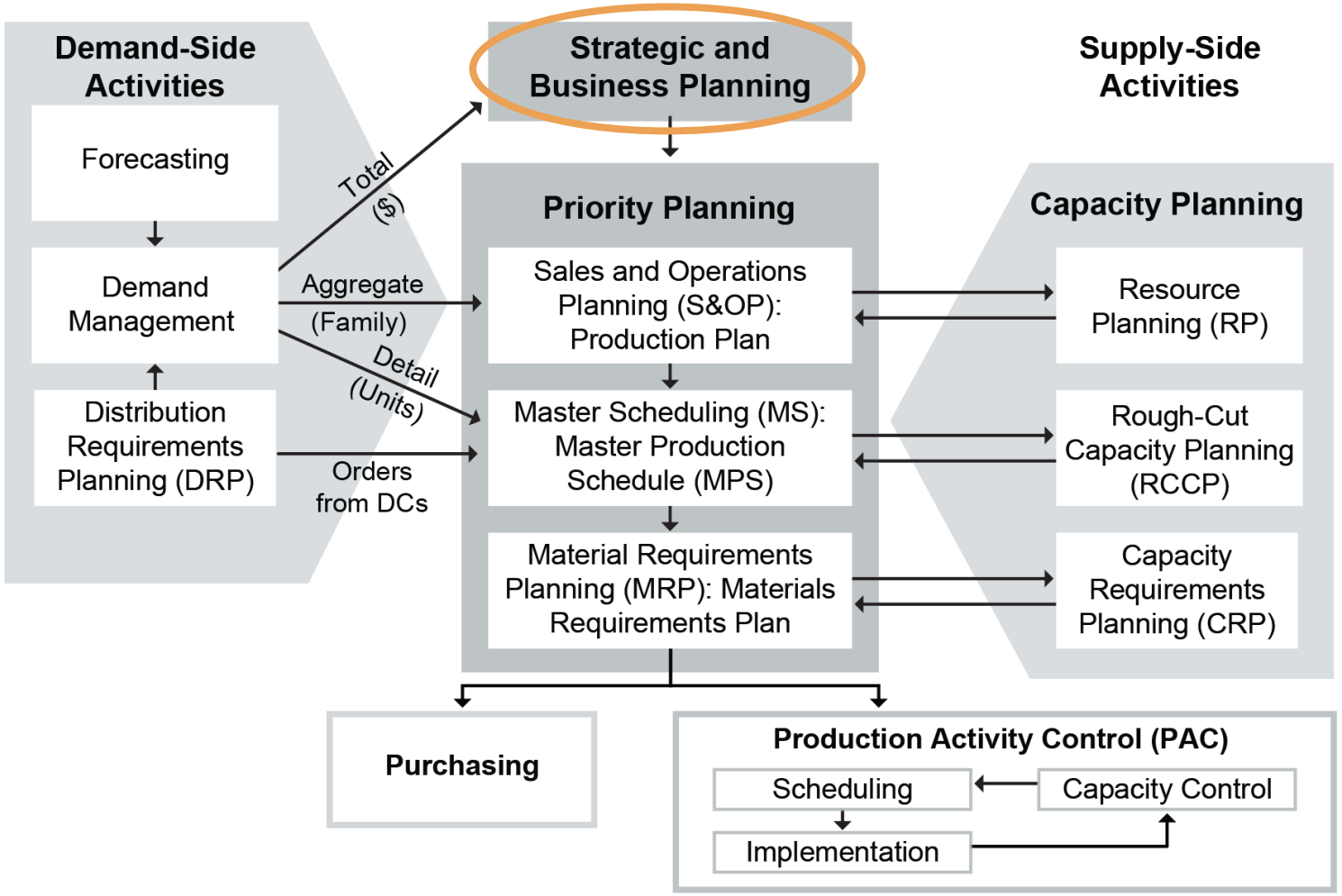
Topic 1: Supply Chain, MPC, and SCOR DS Road Maps



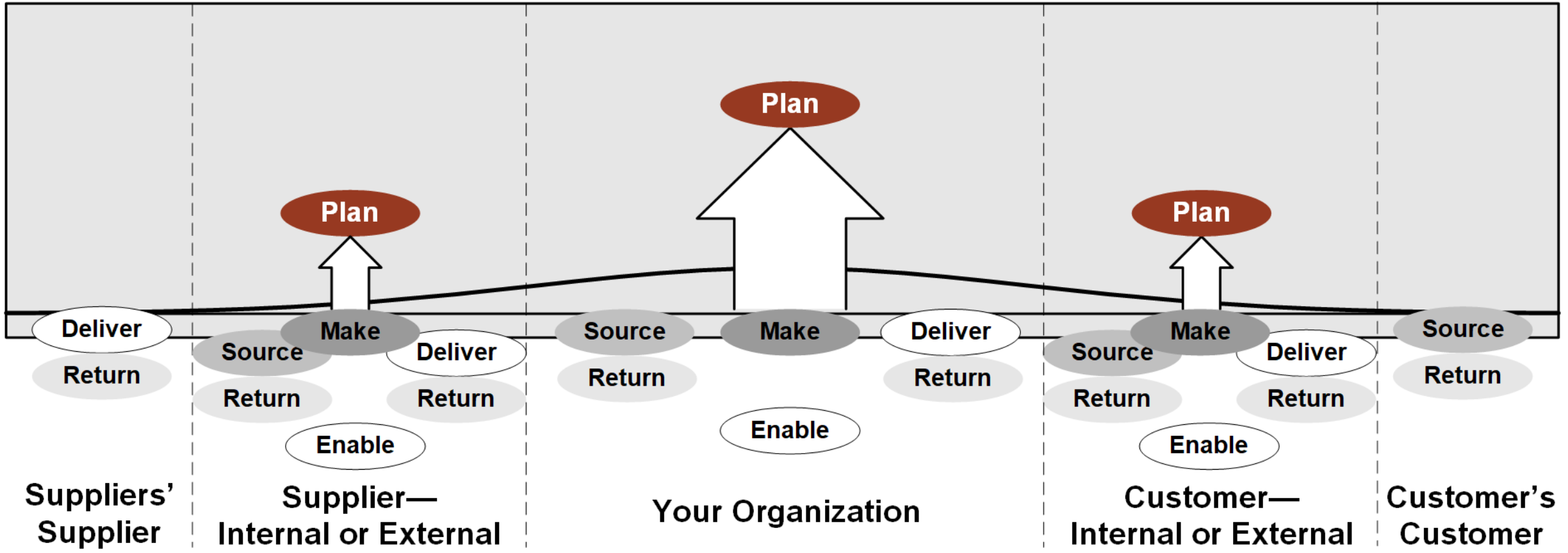
External Environmental Influences



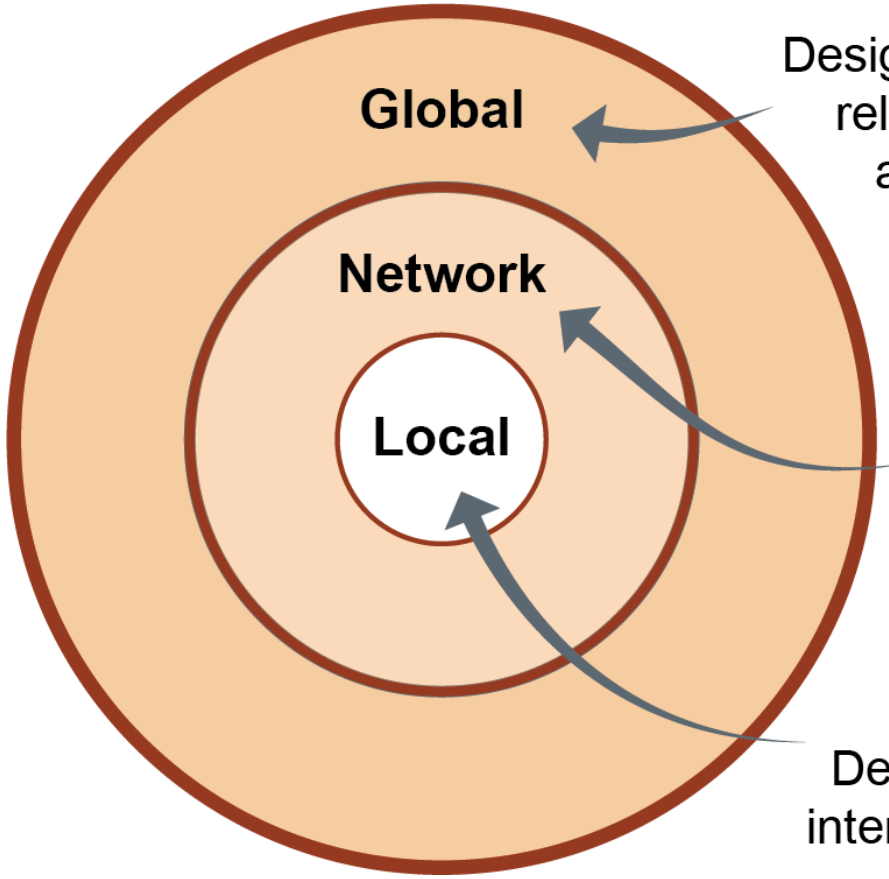
Strategic and Business Planning Directs Manufacturing Planning and Control



Supply Chain Operations Reference Model Digital Standard (SCOR-DS)



Global, Network, and Local Strategic Design Principles

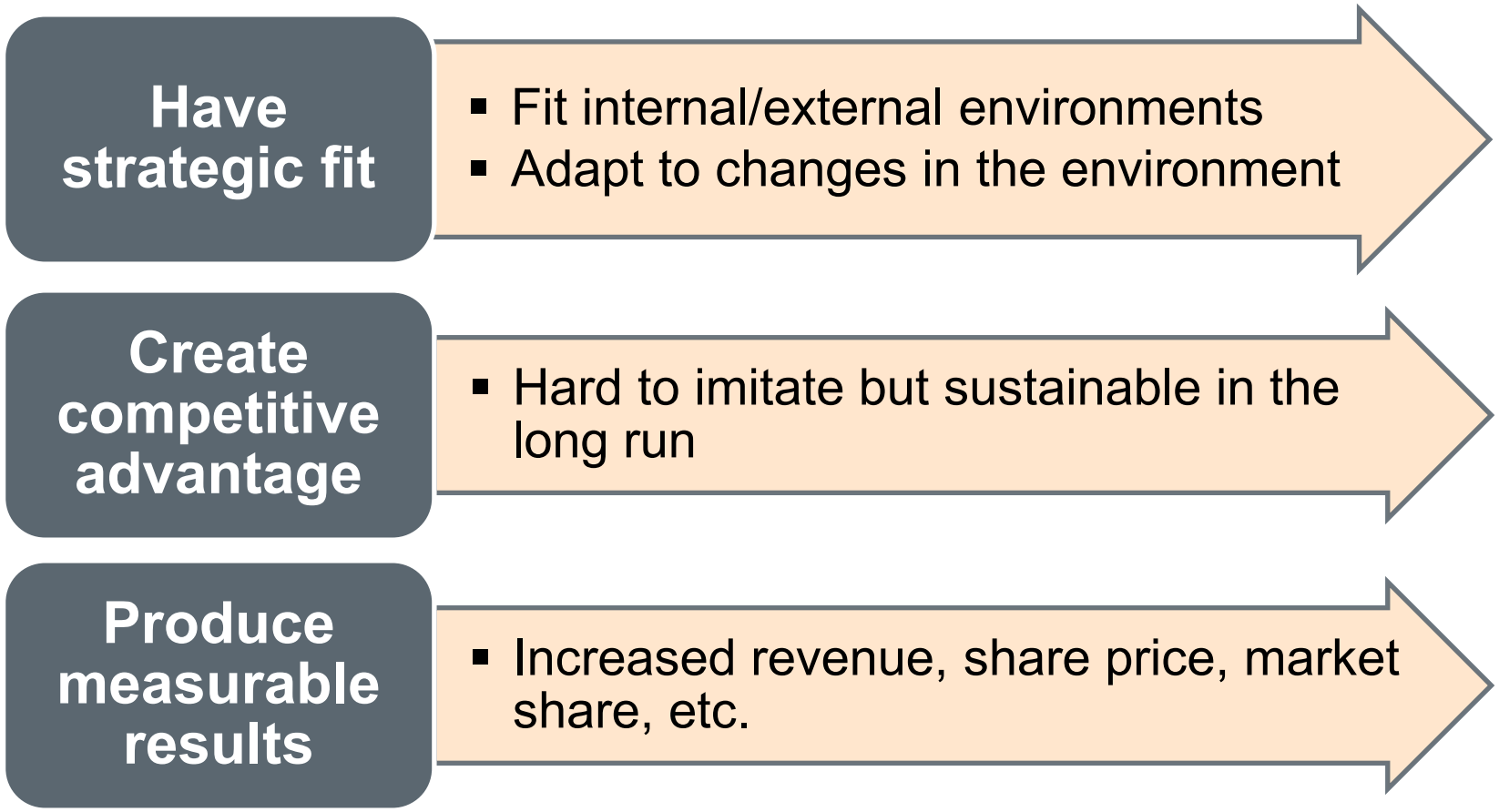


Design principles affecting the organization's relationship to the physical environment and society, including local communities, the workforce, and sustainability

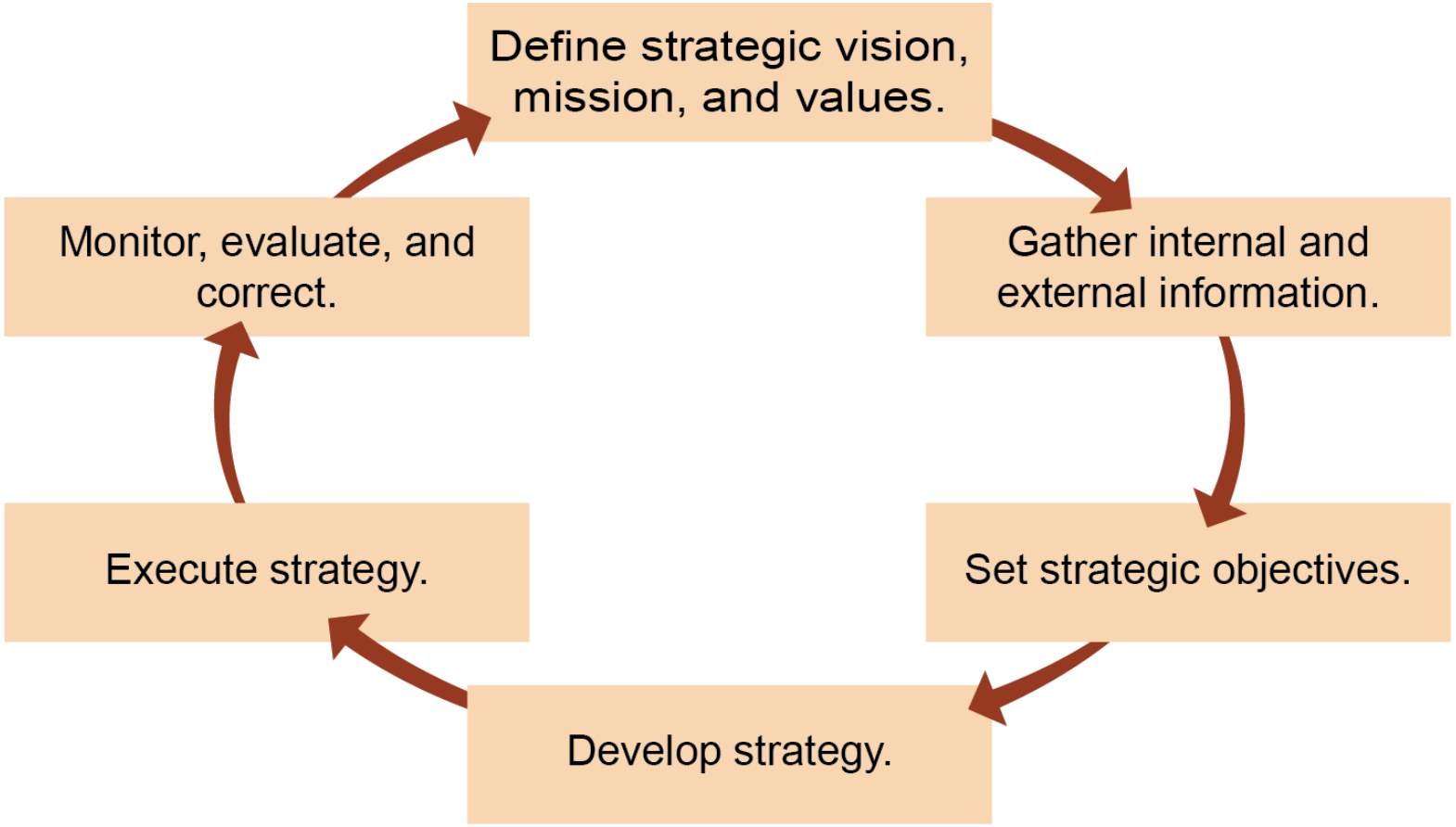
Design principles guiding collaborative interactions with upstream and downstream suppliers and customers

Design principles shaping the internal activities of organizations

Well-Crafted Business Strategies



Strategic Planning and Management Process



What Is Strategy?

- A plan to use the organization's resources to achieve a sustainable competitive advantage
- How the organization
  - Will function and compete in its environment
  - Satisfy customers
  - Grow the business
  - Manage itself
  - Develop its capabilities
  - Achieve its financial objectives

Topic 2: Strategy Road Map

Strategy Hierarchy

Plan to improve competitiveness of the organization as a whole.

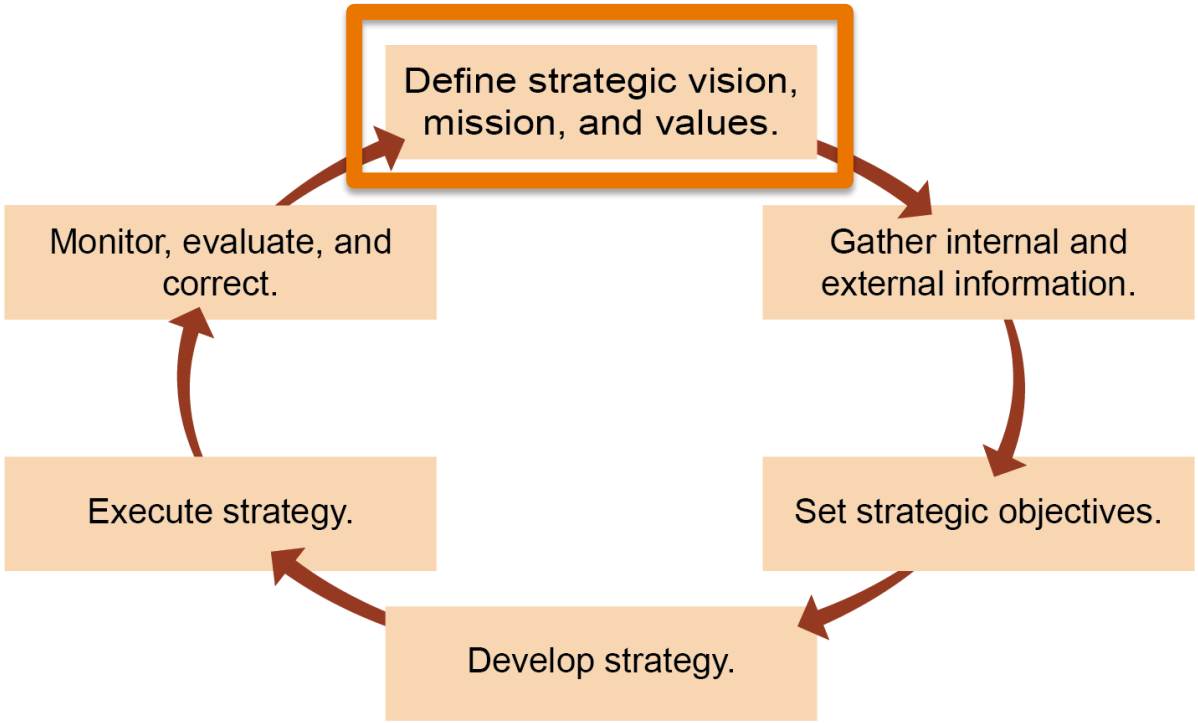
Plan to improve competitiveness of individual line of business.

Plan to implement and support corporate (and business) strategy at functional level.

Plan how the function will perform its work in a manner consistent with the direction and priorities described at the corporate, business, and functional area levels.

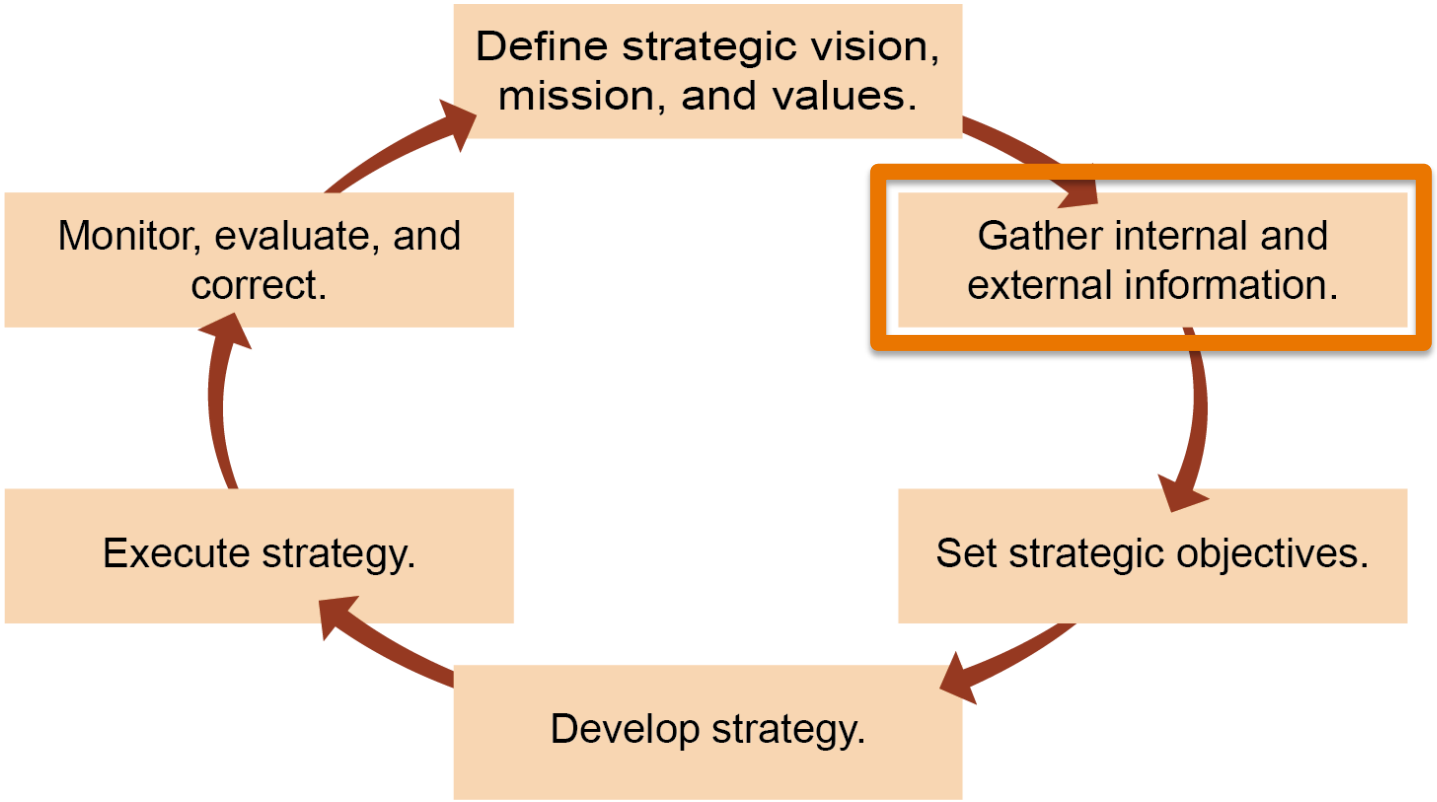
Mission, Vision, and Values

Mission	Vision	Values
Overall goals within business scope	Shared future perception of what the organization wants to become	Organizational guide for all business and ethical decisions and culture



Environmental Scanning

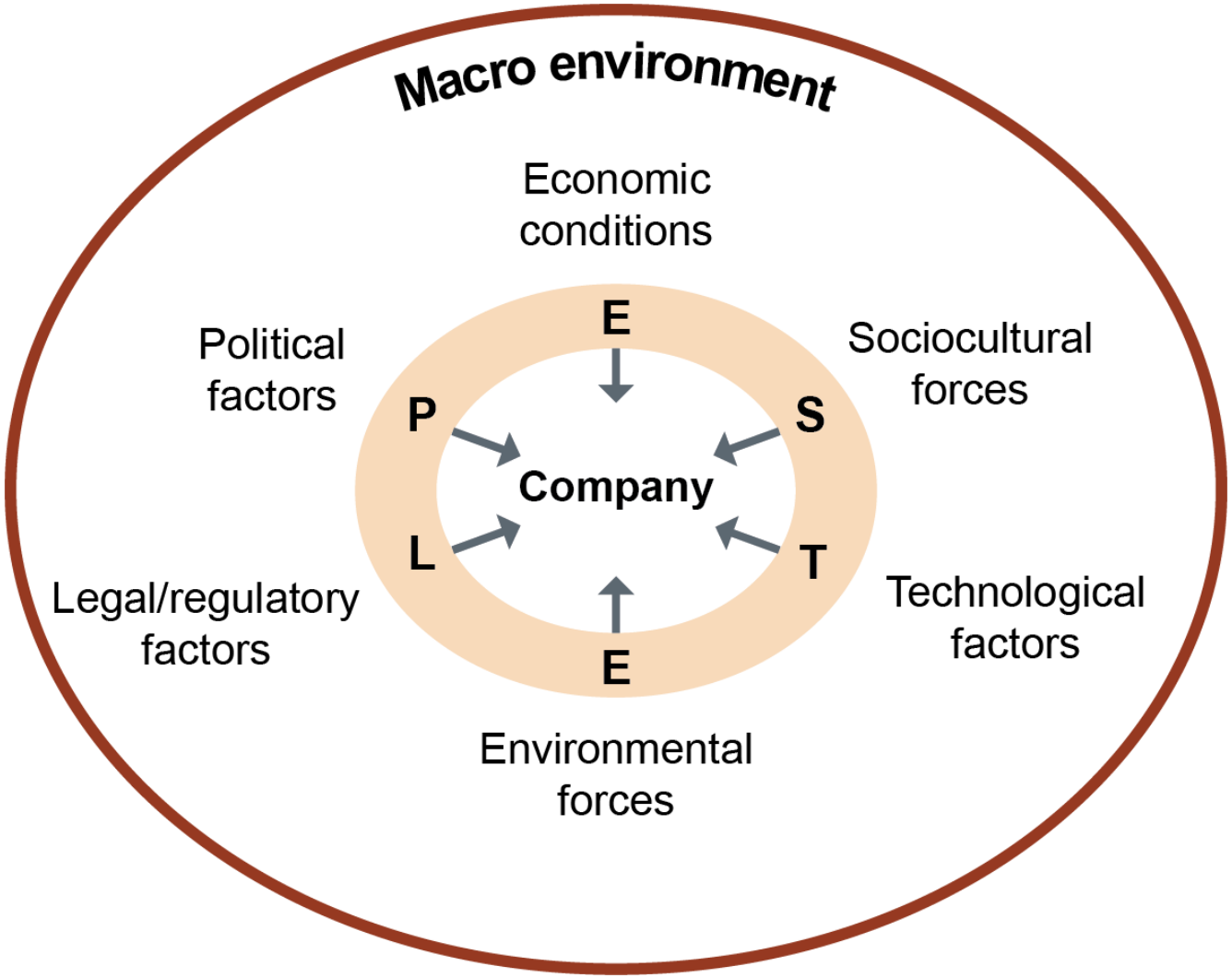
Process used to expose an organization's potential strengths, weaknesses, opportunities, and threats.



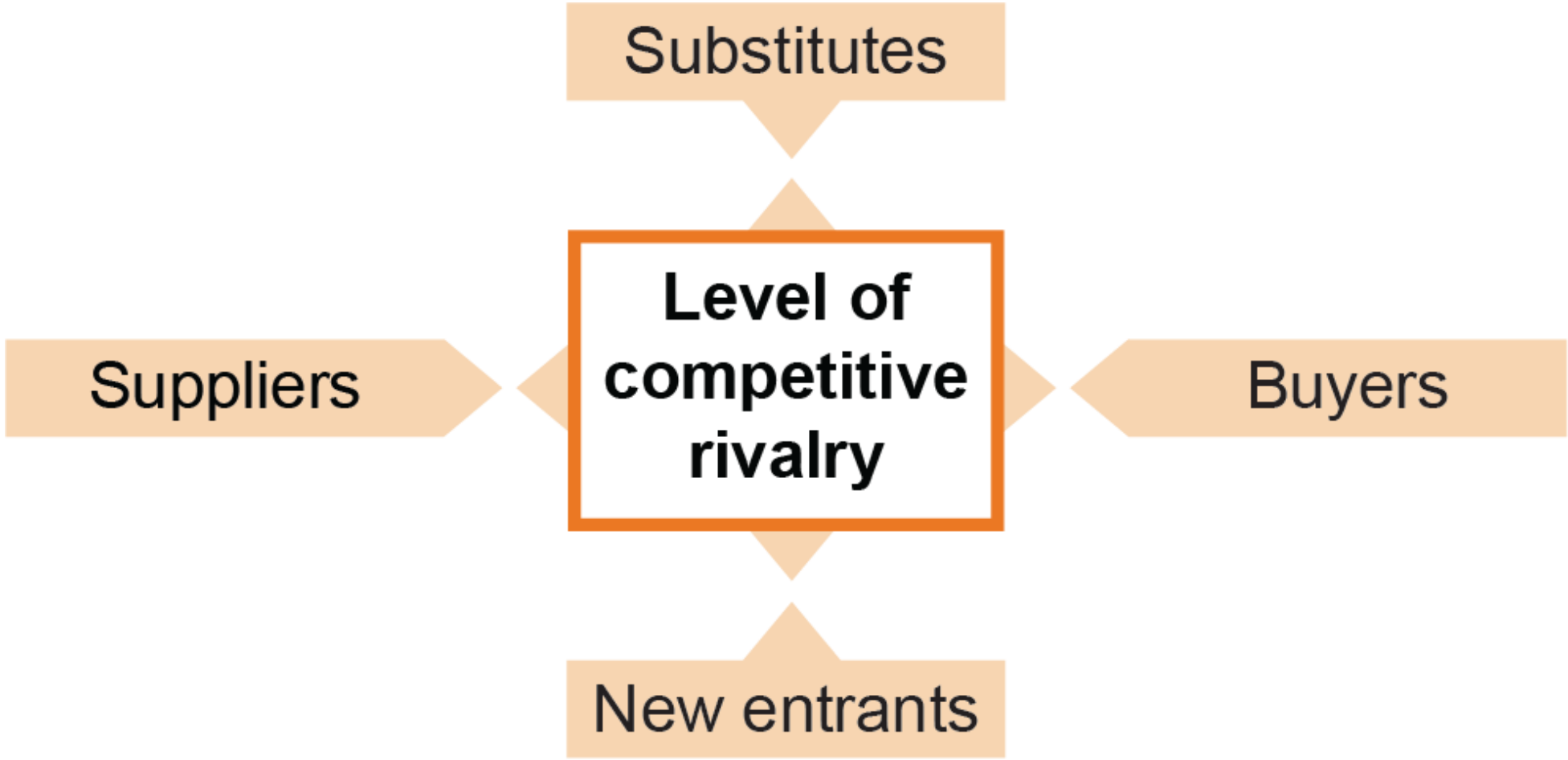
Relevant Industry Information

- Strategic benchmarking
- Competitive analysis
  - Who are major competitors?
  - Where and how do they compete?
  - How aggressively do they compete?
  - What have they done in the past when challenged?
- Opportunities for alliances
- Trends shaping the industry
- Key success factors observed in strong competitors

PESTEL Analysis of Forces in External Environment



Five Forces Framework



Rivalry Among Competitive Sellers

Stronger force

- Slow/declining demand
- Similar products
- Excess supply/capacity
- Diverse strategies
- Strong exit barriers

Weaker force

- Stable/increasing demand
- High switching costs
- Supply and demand usually balanced
- Dominance by a few strong rivals
- Tendency to copy strategies
- Easy to withdraw (e.g., sell assets)

Threat of Entry

Stronger factor

- Industry growth promising
- Lax regulation
- New technologies possible to lessen power of incumbents
- Little customer loyalty

Weaker factor

- Incumbents that can and will react aggressively
- Technology controlled by incumbent patents
- High barriers (e.g., capital costs, locations, networks)
- High loyalty to brand and/or supplier

Substitute Products from Other Industries

Warning signs include

- Possible substitute has a better growth trend than products in the analyzed industry
- Signs that makers of substitutes are increasing capacity
- Evidence that these makers are enjoying better profit margins.

Relative Bargaining Power of Suppliers and Buyers

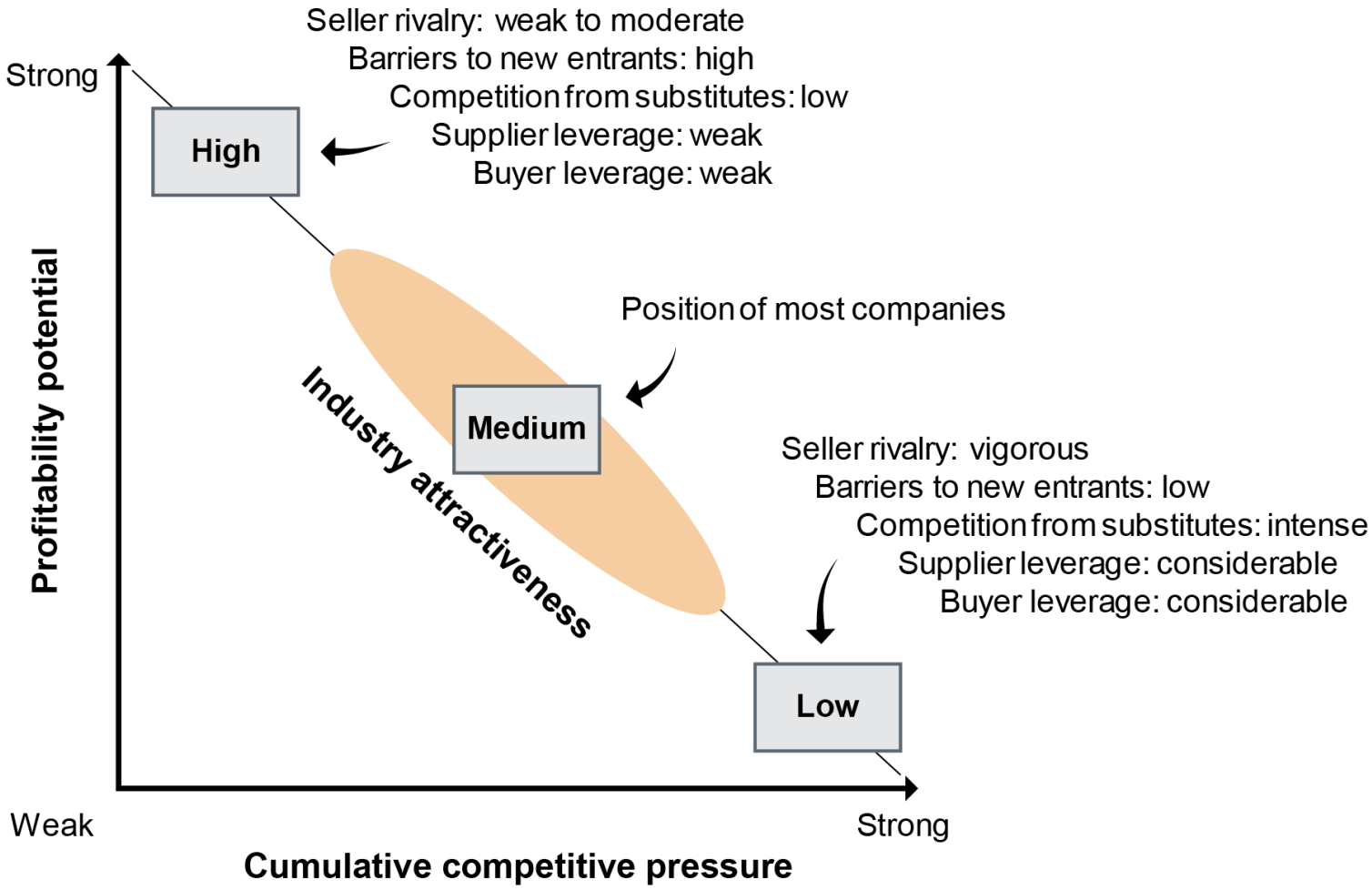
Suppliers have greater power when

- High demand, low supply
- Item has added value
- High switching costs
- Buyers cannot make it themselves
- Minor part of buyer's costs
- Few acceptable substitutes
- Buyer is minor part of supplier's revenue.

Buyers have greater power when

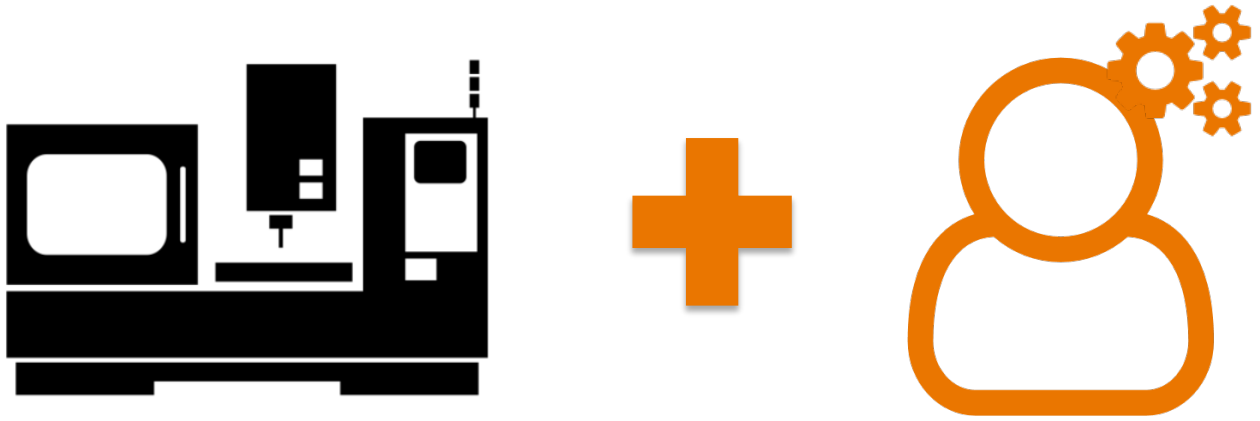
- Weak demand, high supply
- Commodities
- Low switching costs
- Few buyers, many suppliers
- Buyers can make
- Buyers know item's costing
- Buys can be delayed.
- Buyer is price-sensitive.

Industry Attractiveness



Resource and Capability Analysis

- Resource: “Anything that adds value to a good or service in its creation, production, or delivery”
  - Tangible and intangible
- Capability: What skill, knowledge, or ability is required to convert resources into value



VRIN Test

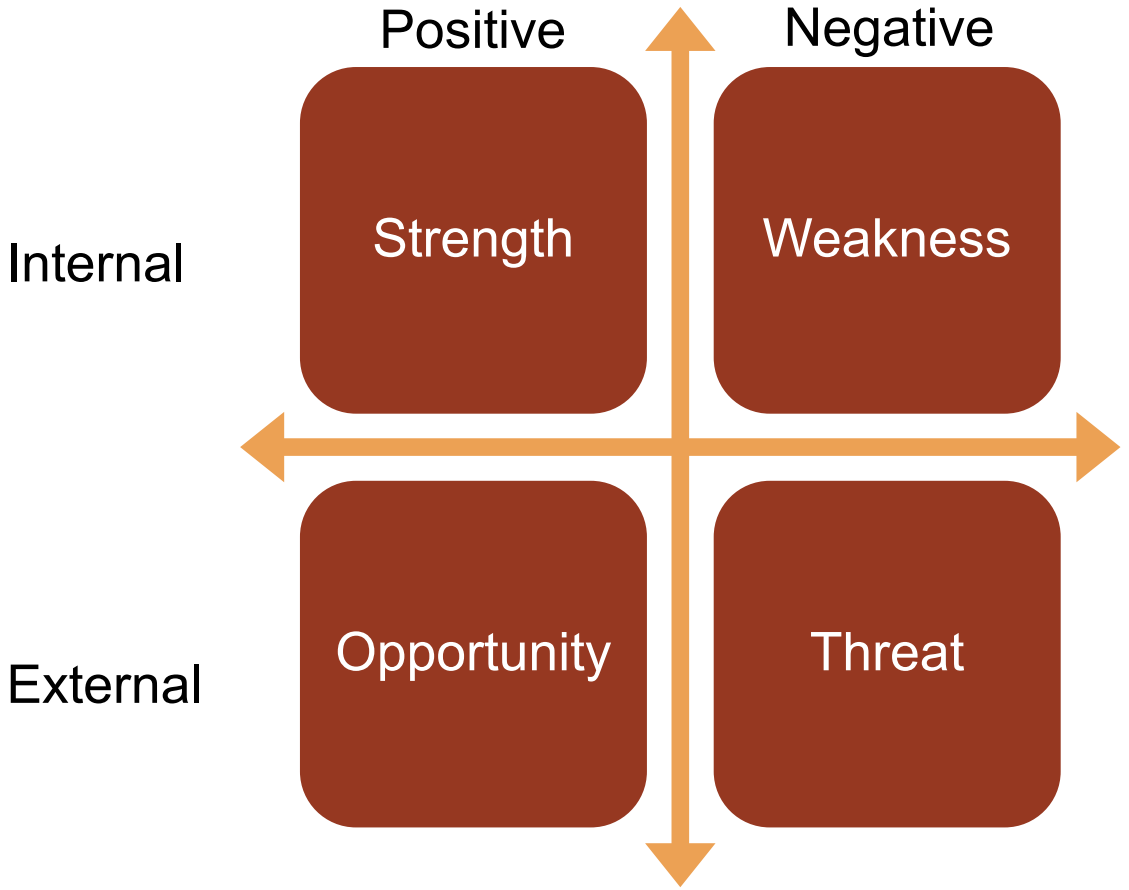
Valuable
- And relevant to the strategy

Rare
- Something you have and rivals lack

Inimitable
- Providing a period of uncontested superiority

Nonsubstitutable
- Superior to other possible approaches

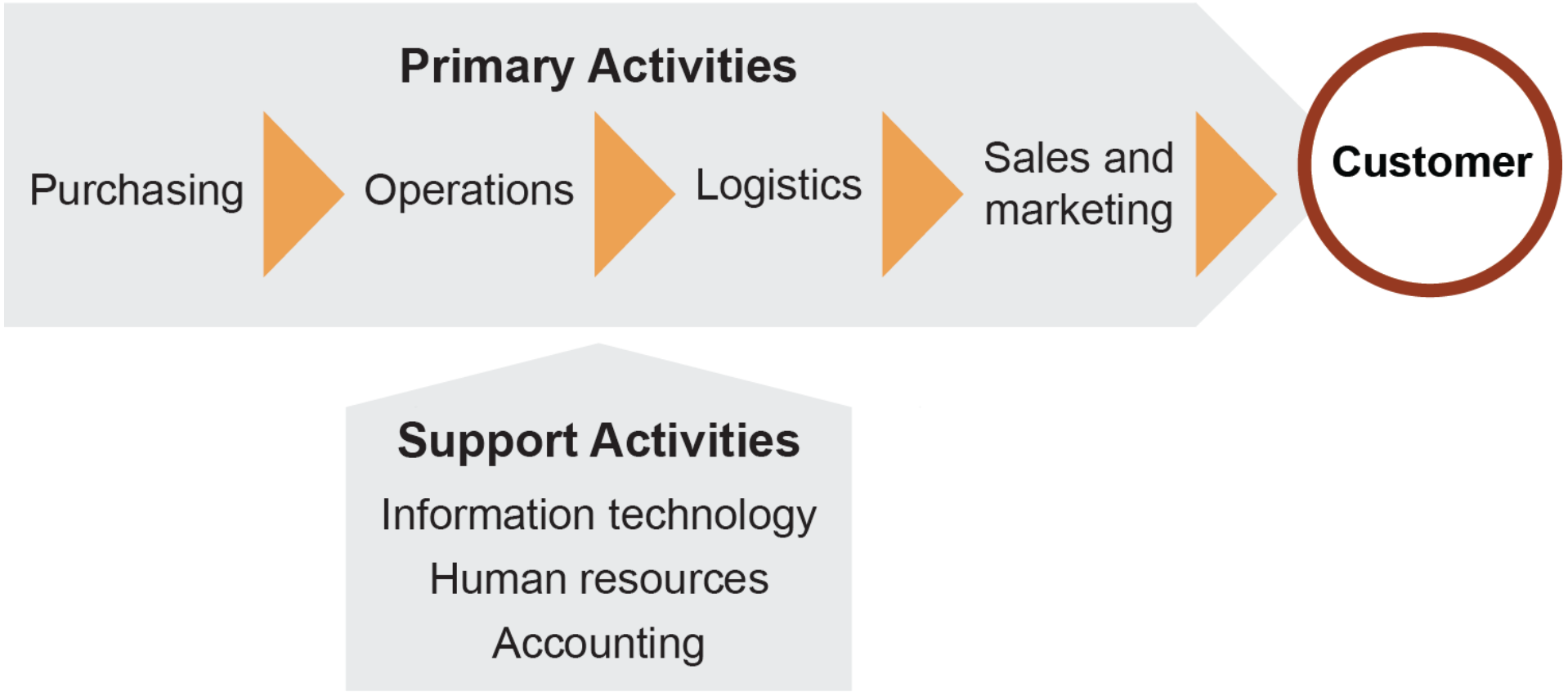
SWOT Analysis



SWOT Analysis and Strategy

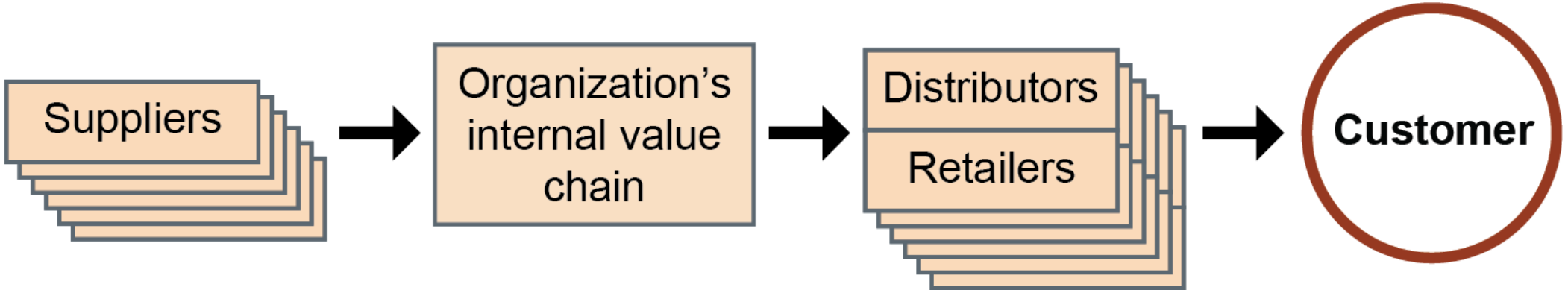
- Strategies should be checked to see if the organization has the necessary strengths.
  - If not, the organization should change course or commit to developing the resources and capabilities.
- Opportunities should be assessed against the organization's ability to exploit the opportunity.
  - Can it leverage unique strengths? How can it mitigate threats? Through self-development or alliances?

Value Chain Analysis: Internal Value Chain

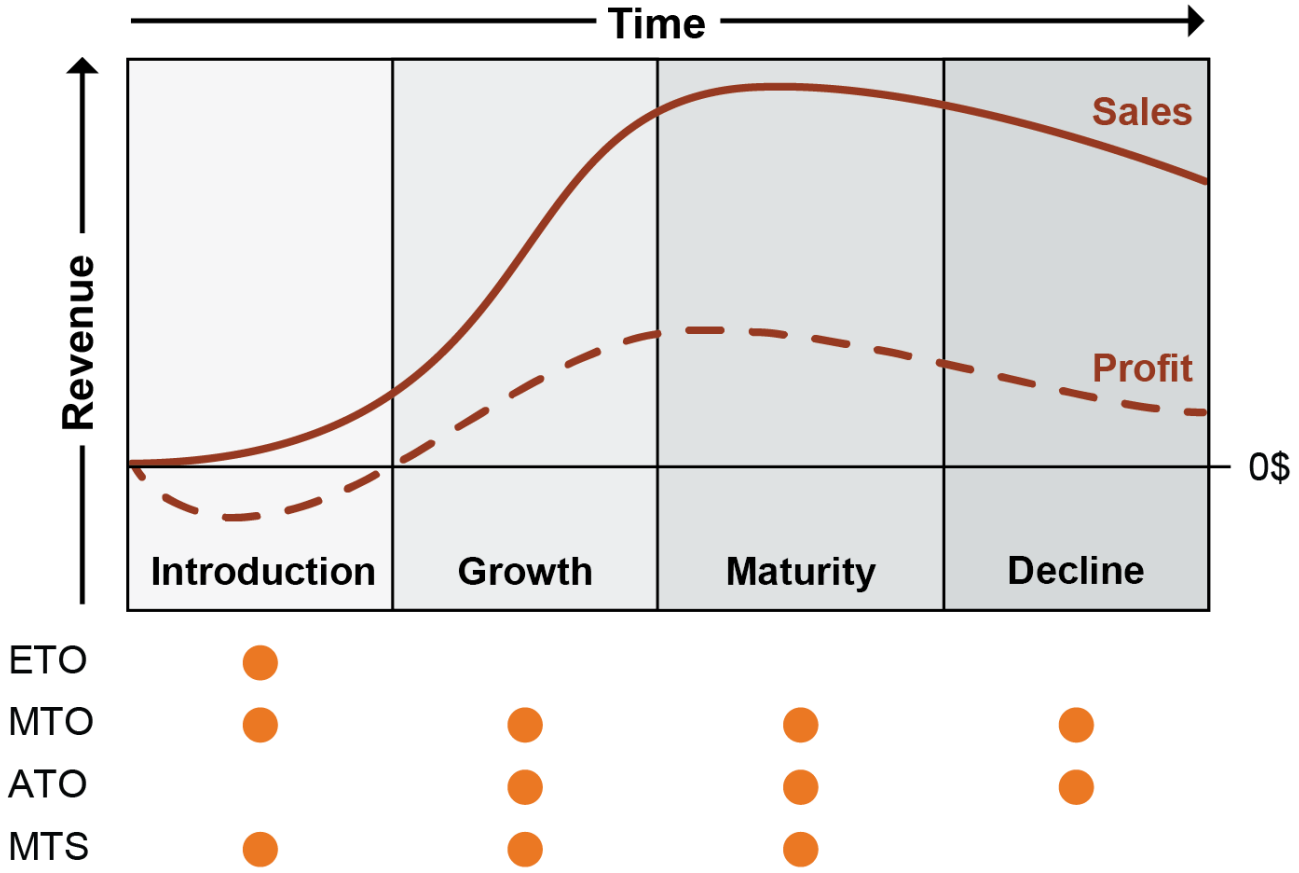


Value Chain Analysis: Value Chain System

- Includes upstream and downstream trading partners—suppliers, distributors, dealers, retailers.
- Value chain analysis examines effects of all the supply chain links on costs and profits.



Product Life Cycle Analysis



- A product's position in its life cycle impacts strategy.
- Short life cycle: maximize revenue generation quickly.
- Positions in life cycle will affect capacity decisions.
- Operations performance objectives may be weighted differently in different phases.

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION B:
STRATEGIC SCOPE AND OBJECTIVES

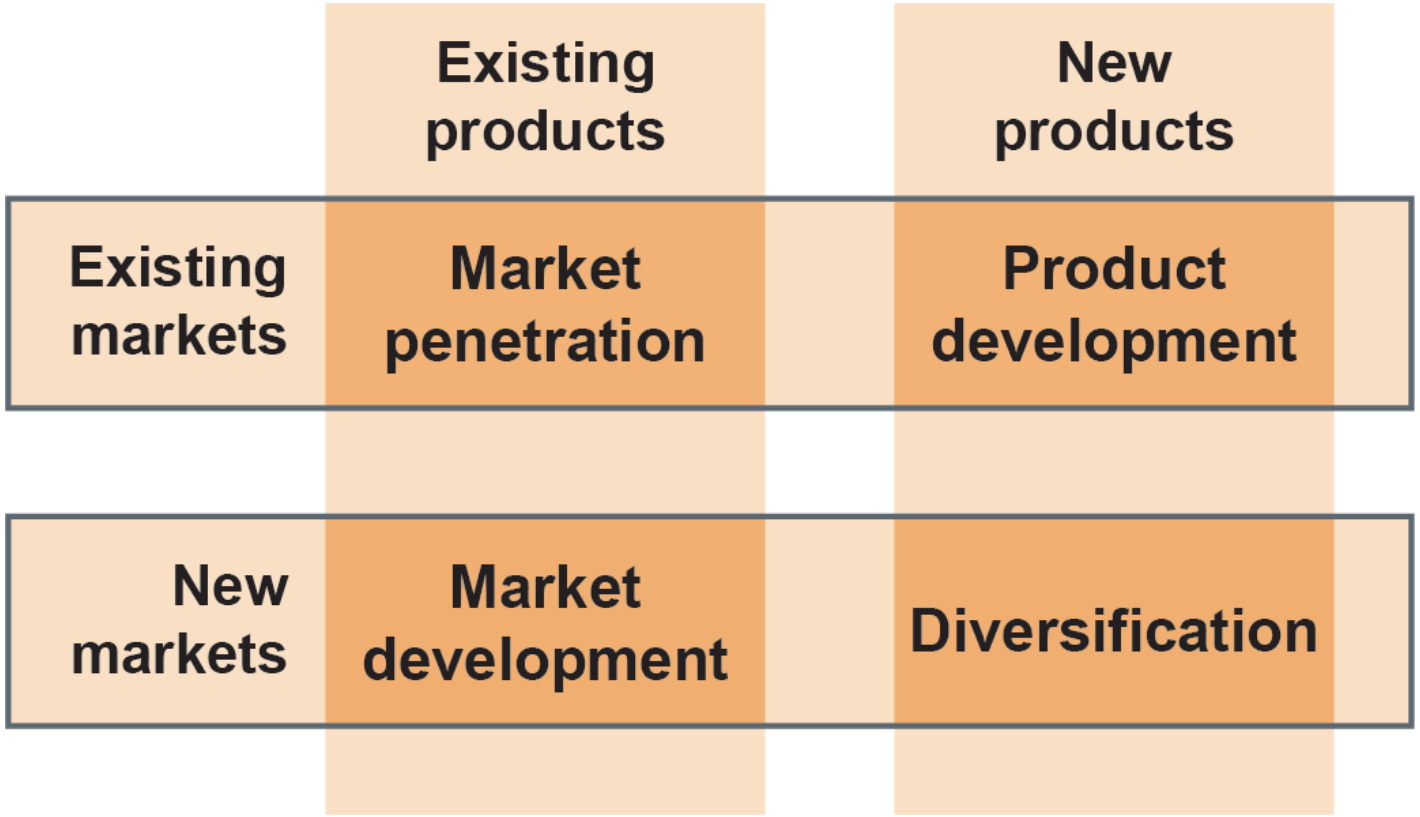
APICS

ASCM

Section B Learning Objectives

- Strategies to increase scope (horizontal and vertical integration, diversification, expansion/globalization)
- Drivers, pros, cons, and risks for different types of strategies
- Globalization strategies
- Customer segmentation
- Generic performance objectives: quality, speed, dependability, flexibility, and cost
- SMART goals and integrated measurement model

Product-Market Growth Matrix



Diversification Strategies: Scope/Market Expansion

Diversification can be an effective strategy when

- Current markets or profitability are declining
- Investing in new lines of business can increase the firm's value and resilience.

Diversification can increase risk, however, from

- Unfamiliarity of new industry
- Inaccurate analysis of value and risks of the move
- Ineffective restructuring of the organization's new lines or divisions.

Related and Unrelated Diversification Strategies

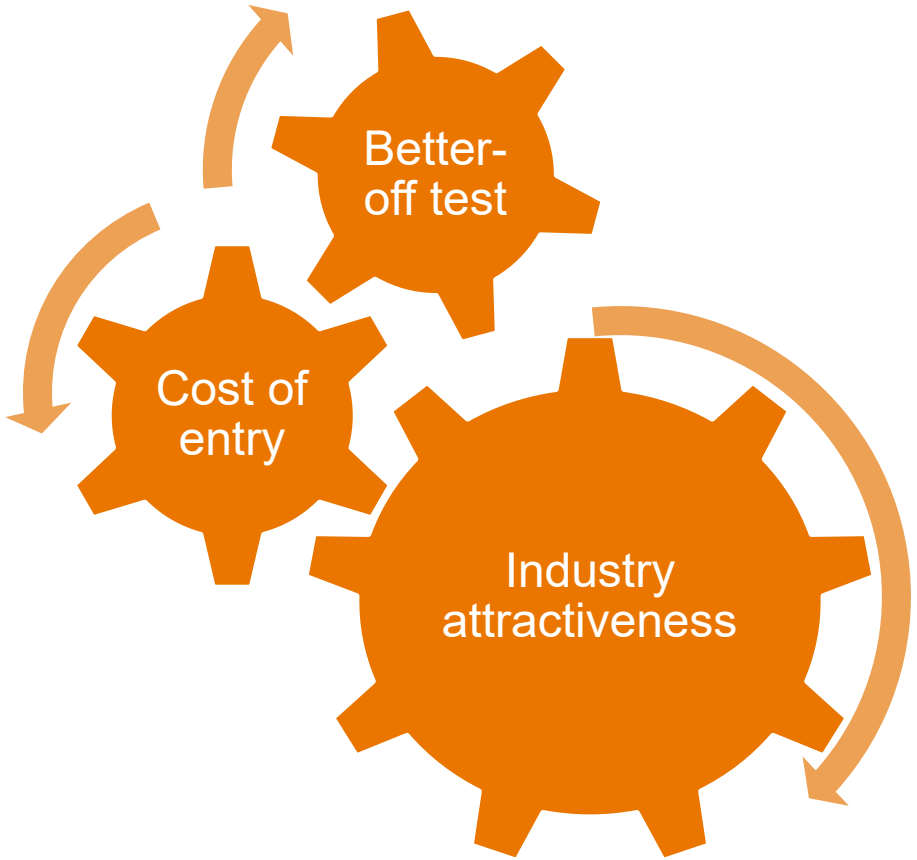
Related diversification

- Growth outside current market or industry, based on similarities between new and current value chain activities.
- Existing brand recognition can be leveraged.
- Shared capabilities and assets generate increased return on investment.

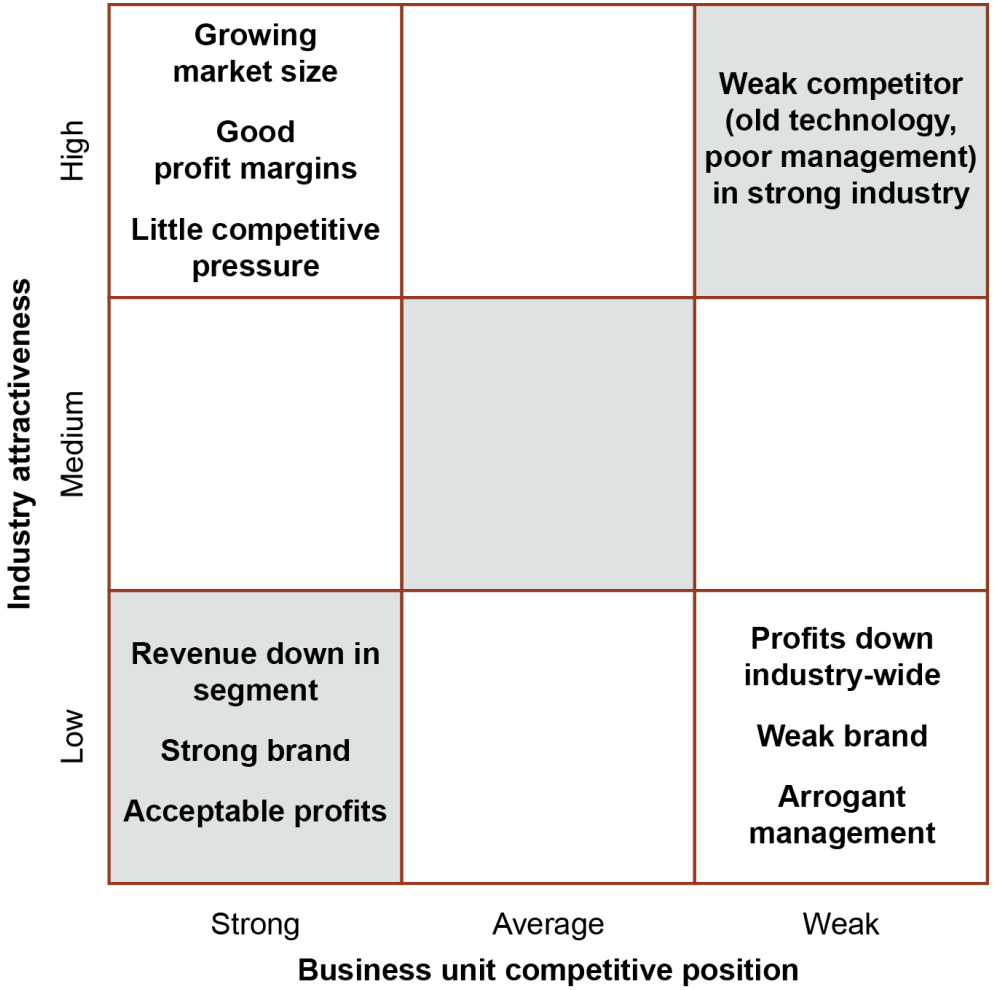
Unrelated diversification

- Growth in markets or industries with different value chain systems.
- Investment of surplus funds.
- Fewer opportunities to leverage existing capabilities or gain knowledge
- Careful market/industry analysis is needed.

Assessing Diversification Opportunities



Industry Attractiveness/Competitive Strength Matrix



Global Expansion

Globalization

- Grow by expanding market beyond current geographical borders, horizontally or vertically

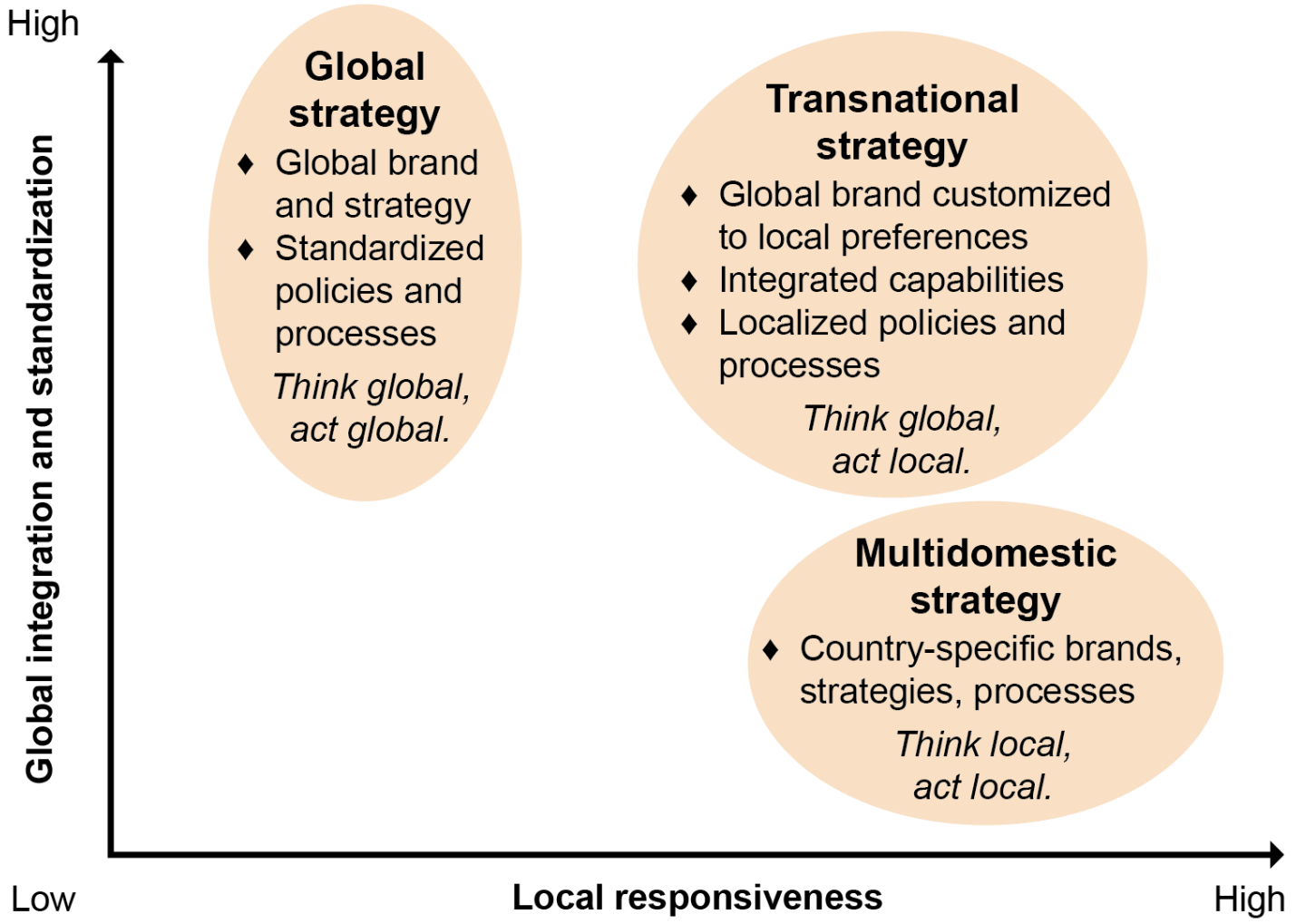
Drivers for globalization strategies

- Saturated or mature domestic markets
- Opportunity to lower costs of production and improve competitive power
- Avoiding negative pressures in home market (e.g., regulation, currency value)

Global Strategies at Work: Profit Sanctuaries

- Firm enjoys strong competitive position in new market.
- Foreign profits support stronger domestic market position and also deter rivals in foreign market.

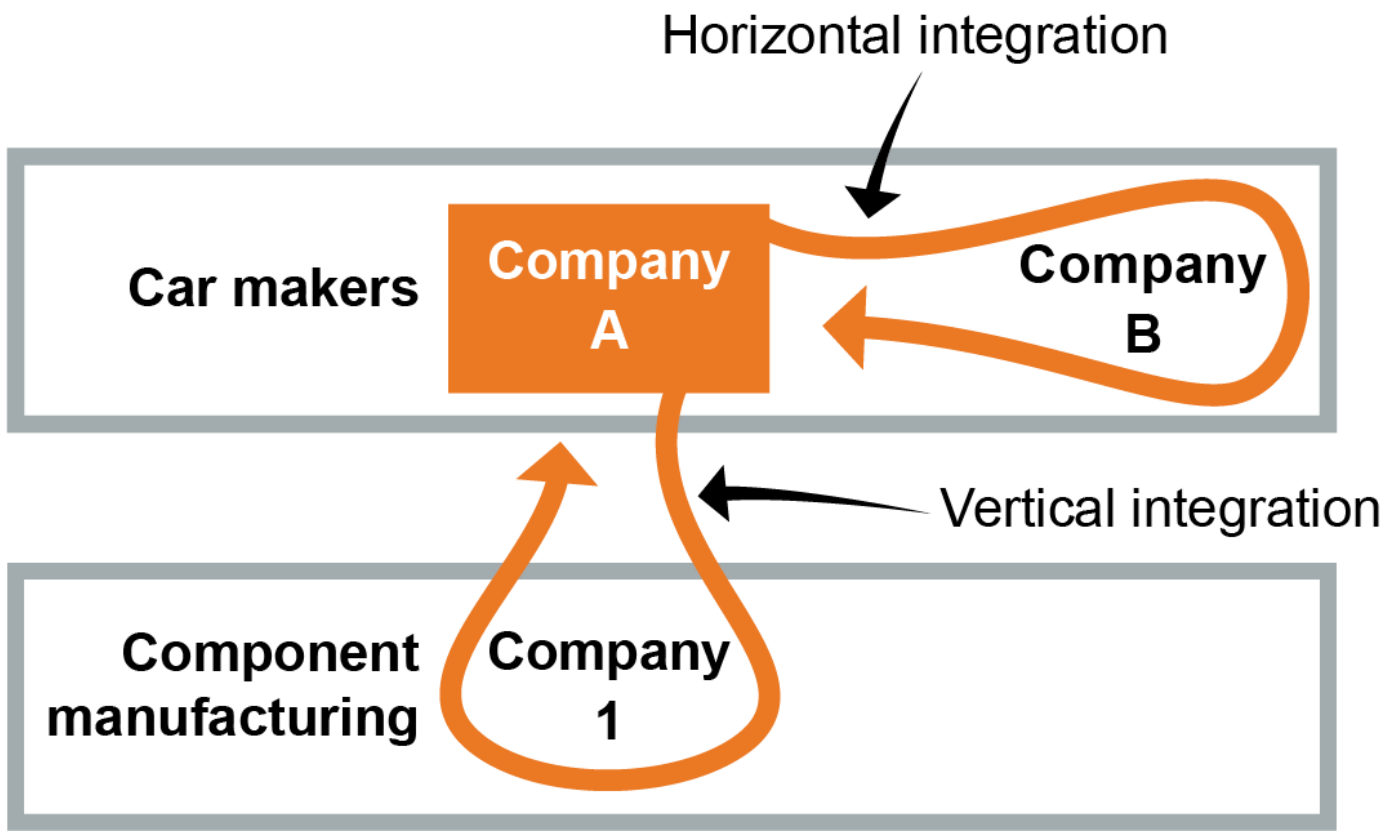
Types of International Strategies



Multidomestic Versus Global Strategy Exercise

Makers of…	Recommended Strategy	Reasons and Assumptions
Personal computers	Global	▪ Global importance of brand name ▪ Regional assembly operations: assemble-to-order or make-to-stock ▪ Economies of scale, low-cost locations, proximity to market ▪ Manufacturing excellence and mass customization capability
Soups	Multidomestic or transnational	▪ Significant differences exist in local market preferences, brand still important. ▪ In small markets, consider outsourcing to third party, or supply through regional operations in low-cost locations. ▪ Consider licensing in mid-size markets with tight control of branding. ▪ Consider full operations (joint ventures) in large markets.

Horizontal and Vertical Integration



Paths to Horizontal Growth

Develop new capabilities in-house.

Acquire new capabilities (e.g., merger or acquisition).

Outsource a capability (e.g., logistics manager or third-party logistics provider).

Mergers and Acquisitions (M&A)

Definition of merger

- "Acquisition of the assets and liabilities of one company by another"

M&A objectives

- Create cost efficiencies.
- Expand geographical coverage.
- Extend product offerings.
- Gain access to technology, resources, or capabilities.
- Support organization's adaptation to industry evolution.

Vertical Integration

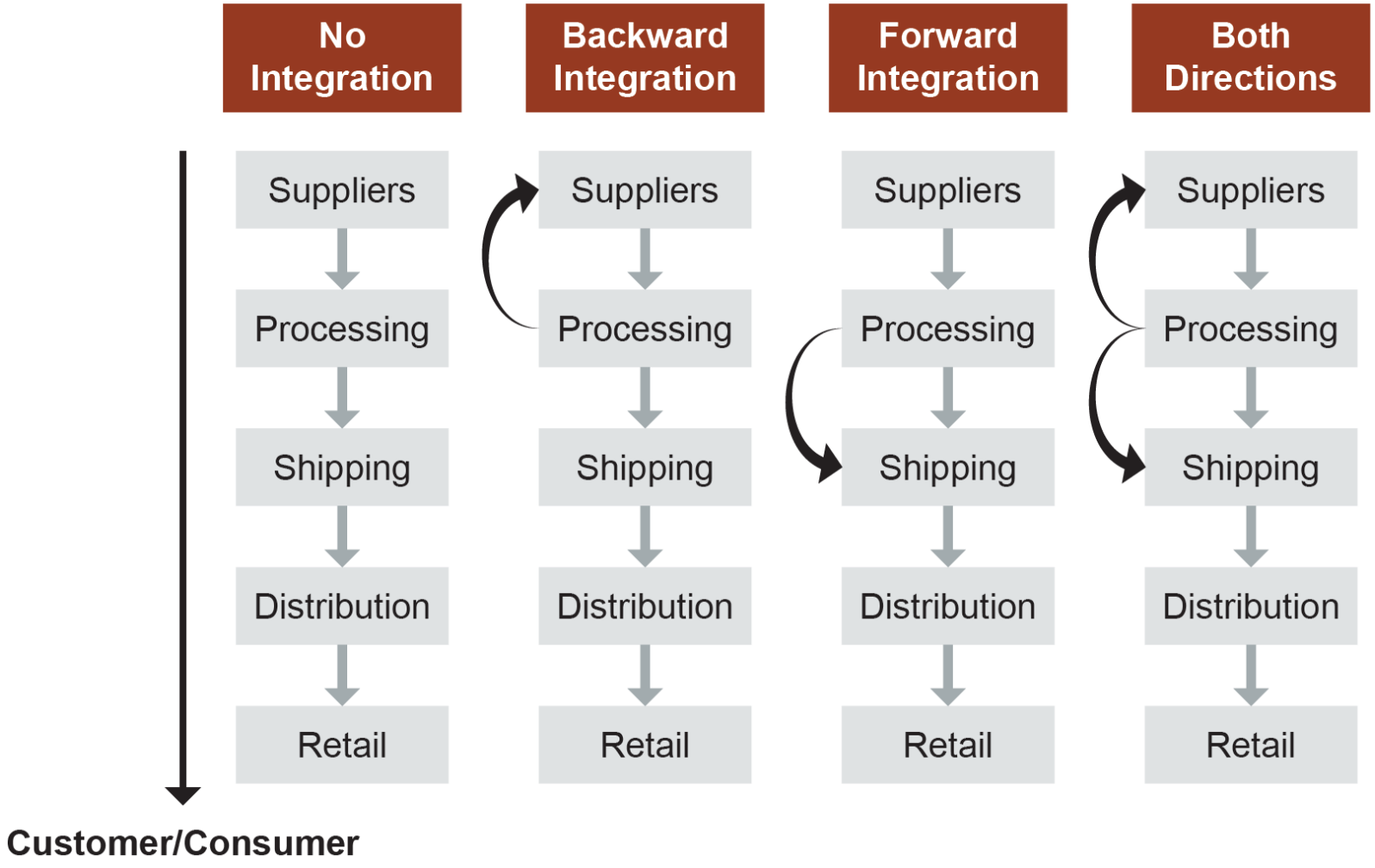
Definition of vertical integration

- "Degree to which a firm has decided to directly produce multiple value-adding stages…
- The more steps in the sequence, the greater the vertical integration."

Vertical integration challenges

- Difficulty in mastering new technology, knowledge, skills
- Increased risk caused by changes in industry practices
- Uncertain cost efficiency advantages
- Capacity imbalances

Backward and Forward Integration



When Does Backward/Forward Integration Make Sense?

Backward integration

- An organization can produce items with at least as much efficiency, reliability, and quality.
- Does add risk by focusing outside core competencies.

Forward integration

- An organization gains more control over distribution and sale of their goods.
- Can be monopolistic or create ill will with current distributor network.

Outsourcing as an Integration Strategy

"Process of having suppliers provide goods and services previously provided internally…replacement of internal capacity and production"

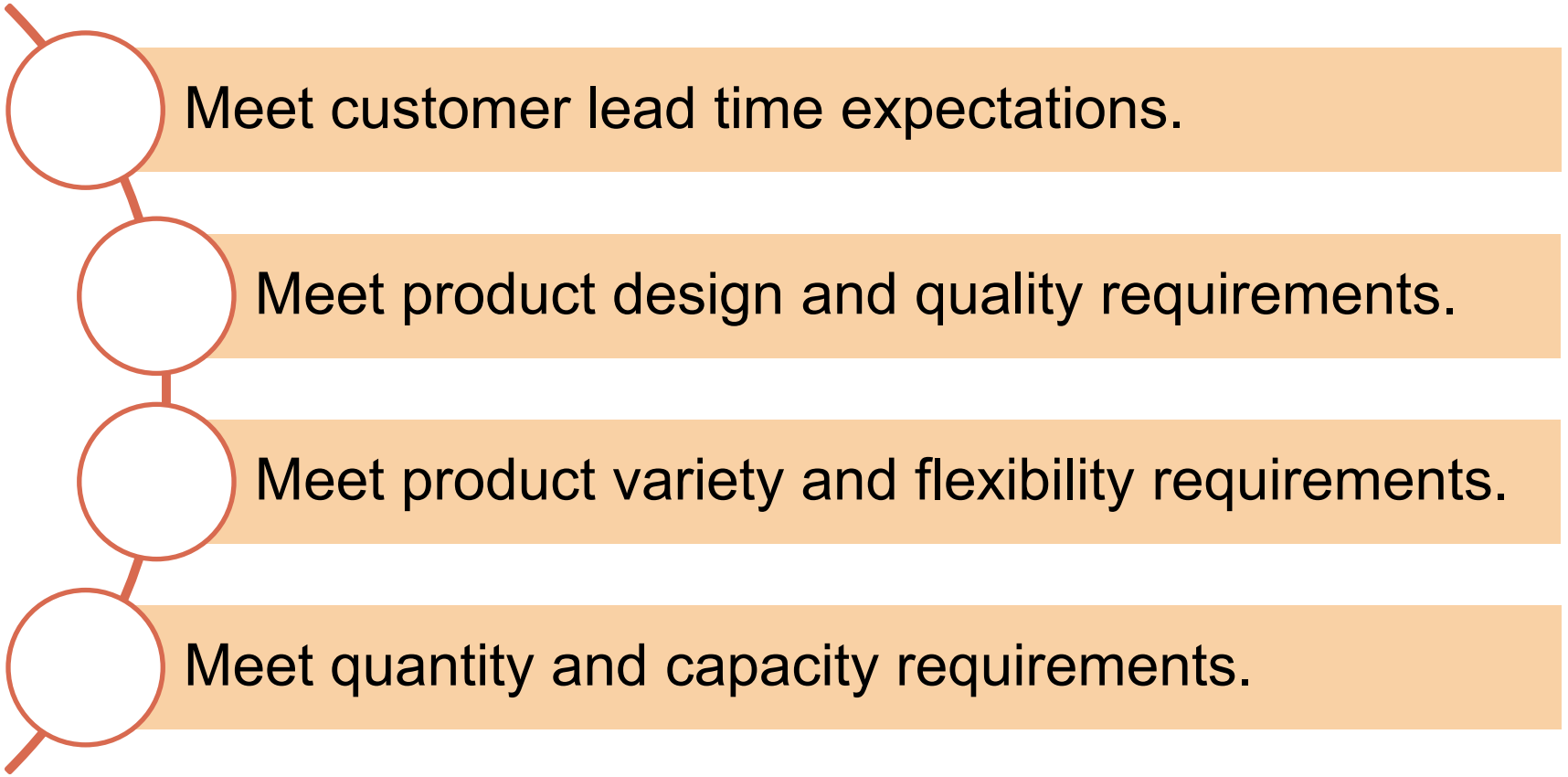
- Opposite of integration: Activities are added to the value chain.
- Good idea when activities can be performed more cheaply and quickly with at least equal quality.
- Increases risk from loss of control.
- Core competencies should not be outsourced.
- Alternatives include various types of partnerships/alliances.

Market and Customer Segmentation

"The practice of dividing a customer base into groups of individuals who are similar in specific ways relevant to marketing."

Customer Value Proposition	Customer Experience	Value of Customer Segment
▪ What the customer will and will not pay for	▪ The voice of the customer ▪ How the customer uses the products	▪ Cost of acquiring and keeping customers ▪ Relative value of customer segments

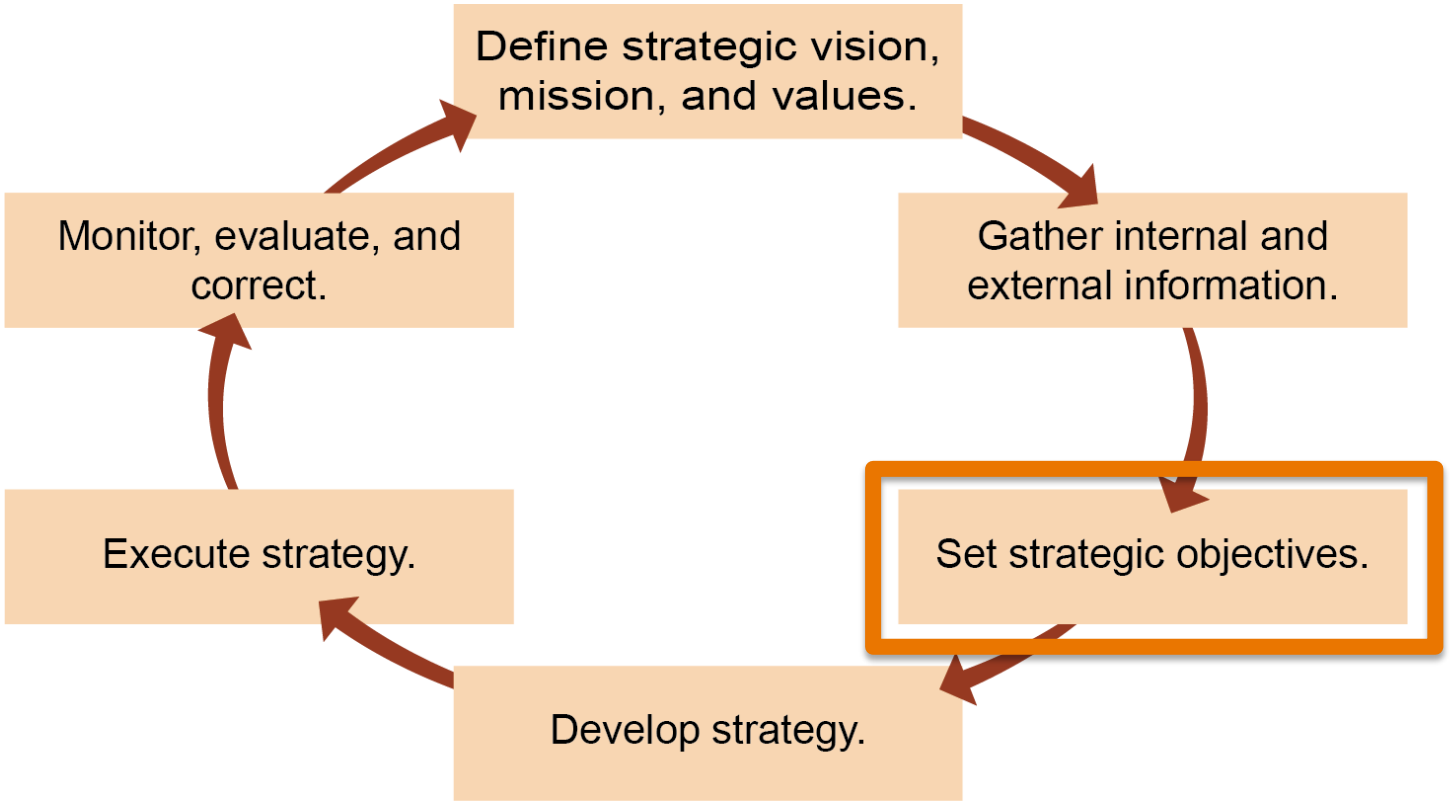
Local Strategic Design Principles for Customers



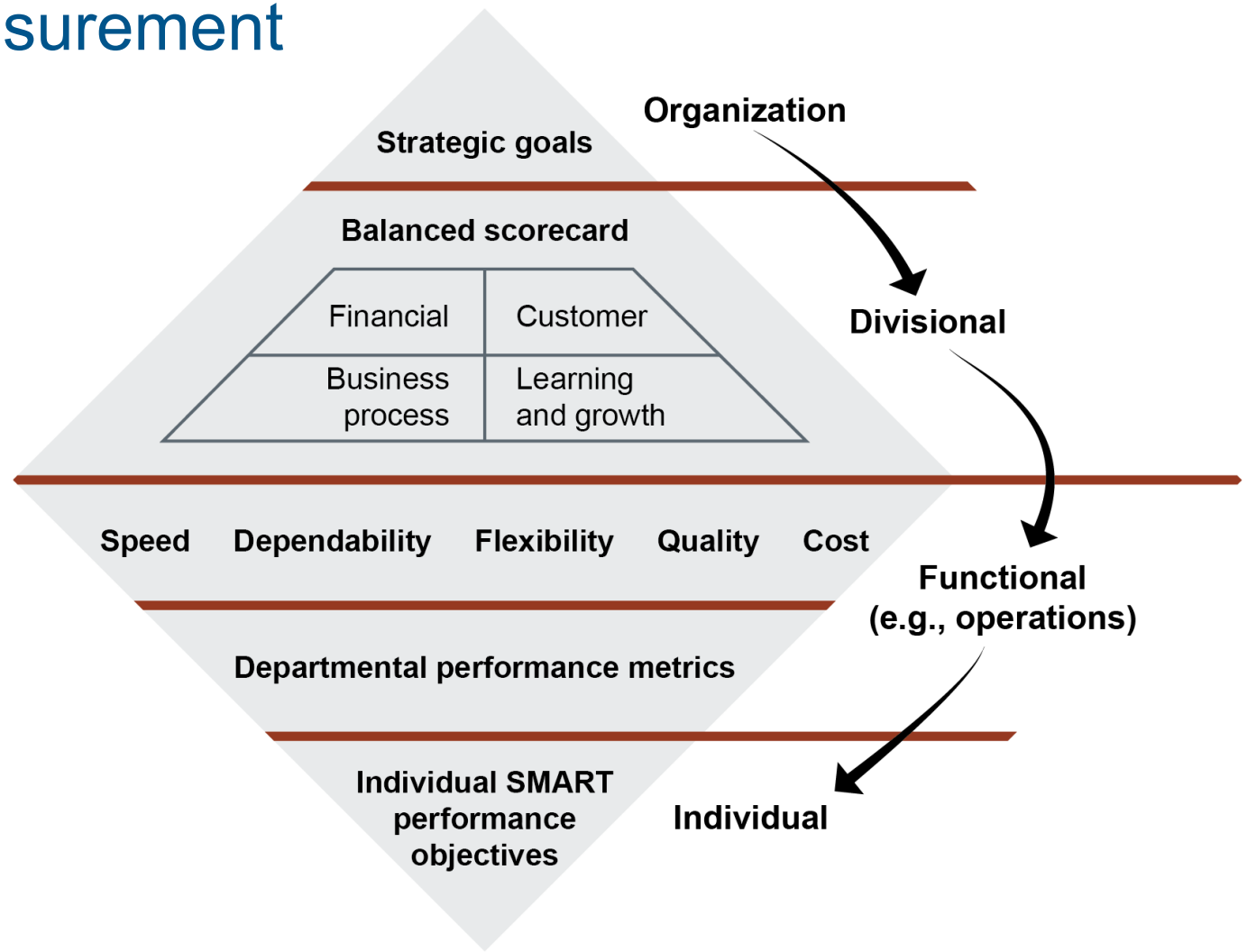
Set Objectives

Objectives turn mission and vision into actionable goals.

- Ensure strategic alignment and accountability.
- Align decisions and actions with strategic goals.
- Set basis for measuring effectiveness of strategy/implementation.
- Motivate everyone to achieve and surpass goals.



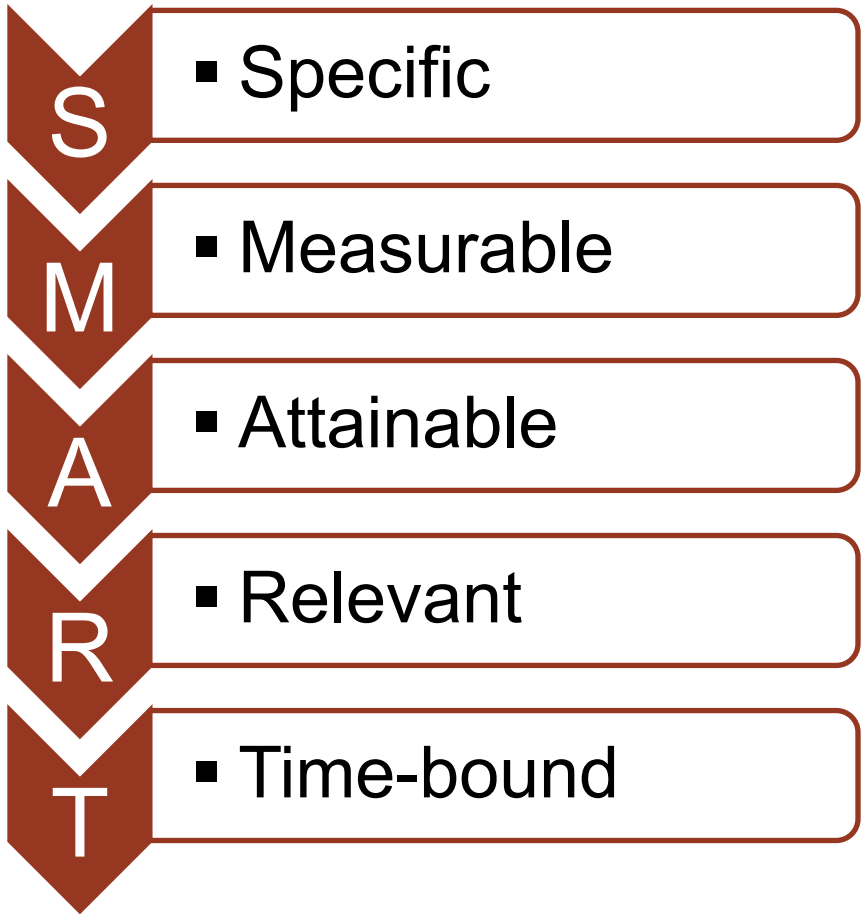
Integrated Measurement Model



Generic Performance Objectives at the Functional Level

Category	Description	Tradeoff
Speed	Time to market, lead times, output, and/or delivery	Fast equipment may be less flexible; speed has a cost.
Dependability	Promise fulfillment, on-time delivery, product durability	Unused or redundant capacity adds flexibility and disruption resilience but at a cost.
Flexibility	Agility to ramp up or down in volume or change production mix without significant disruption	Flexibility can reduce economies of scale; specialized vs. generalized.
Quality	Fitness for use, product attributes, compliance with specifications	Tighter specification limits may limit speed or flexibility; lower long-term cost.
Cost	Goods at lowest price relative to competition, return on capital, business viability	Competitive price is qualifier; lowest price limits priorities.

SMART Objectives



- SMART objectives translate strategy into actual results.
- What-if analysis to determine strategy profitability.
- Tactics and operations must link back to strategy.

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION C:
DEVELOPING AND MANAGING ORGANIZATIONAL STRATEGY

APICS

ASCM

Section C Learning Objectives

- Order qualifiers and winners
- Generic business strategies:
  - Low-cost provider
  - Differentiation
  - Focused low-cost provider
  - Focused differentiation
  - Best-cost provider
- For each strategy:
  - Impact on organization
  - Under what conditions it may be effective
  - Risks the organization should prepare to face
- Execute strategy with policy, process, feedback
- Next big opportunity

Order Qualifiers, Winners, and Push/Pull

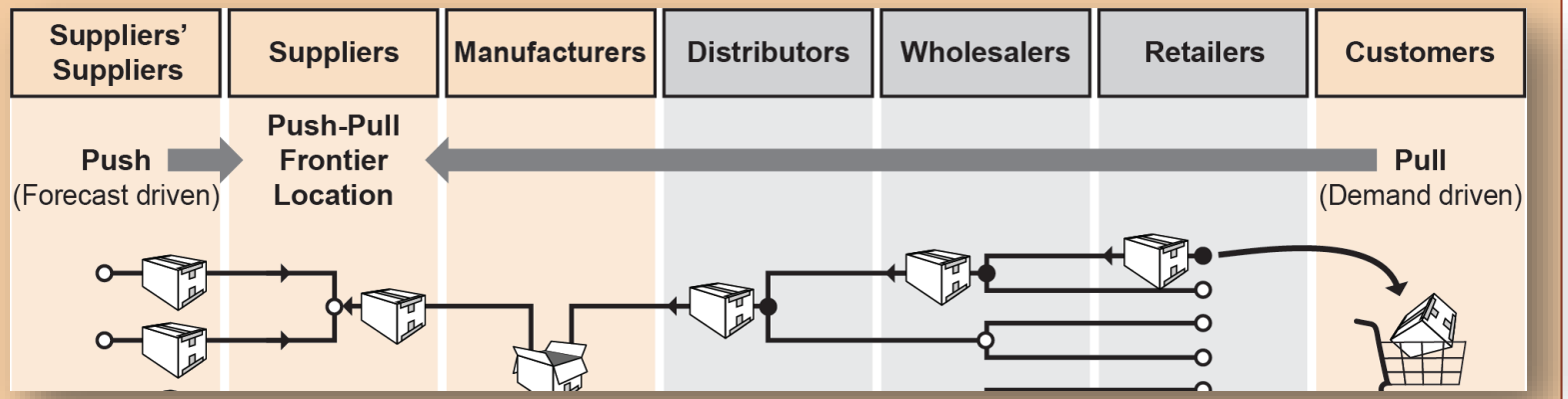
Order qualifiers

- What a firm must exhibit to be a viable competitor.
- Winners tend to become qualifiers over time.

Order winners

- What causes a customer to choose a firm over its competitors.

Order winners and qualifiers plus the location of the push/pull frontier are two of the strongest manufacturing environment determinants.

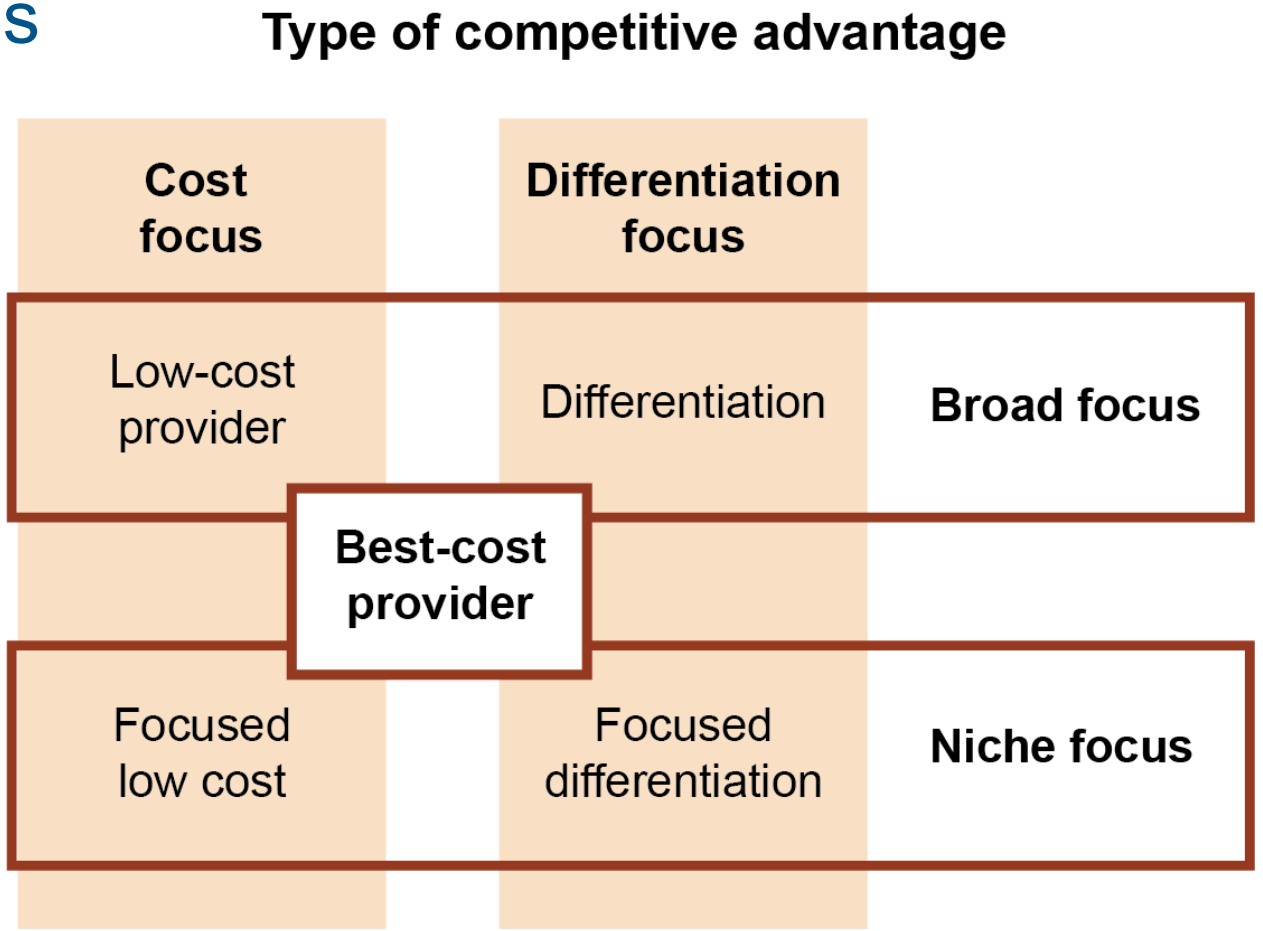


Product Profiling and the Product Life Cycle

Compare manufacturing capabilities to order-winning criteria

Life Cycle Phase	Customer Type	Qualifiers	Winners
Introduction	Innovators	Quality, flexibility	Meet actual specifications
Growth	Early adopters	Cost, flexibility	Dependability
Maturity	Most of market	Quality, flexibility (product range)	Cost, dependability
Decline	Replacements or late adopters	Dependability	Cost

Porter's Generic Competitive Strategies

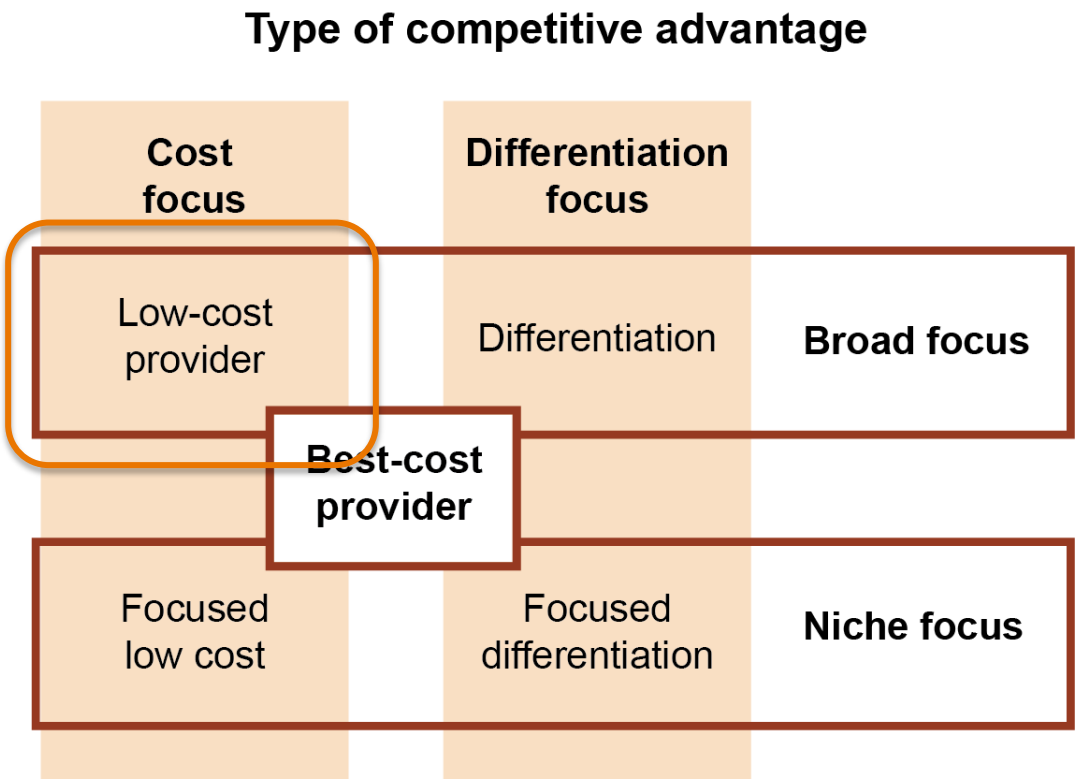


Competitive Strategies

- It is possible for divisions within an organization to have different strategies.
- But implementing two strategies simultaneously within a single entity (e.g., division) is challenging.
- The choice of strategy involves tradeoffs.

Low-Cost Provider Strategy

- Value based on lower or lowest price vs. competitors
- Paths to profit:
  - High volume to generate profit
  - Lower volume/higher profit margin
- Tactics:
  - Reduce features and/or quality
  - Reduce costs of production



Low-Cost Provider Tactics and Risks

Additional tactics

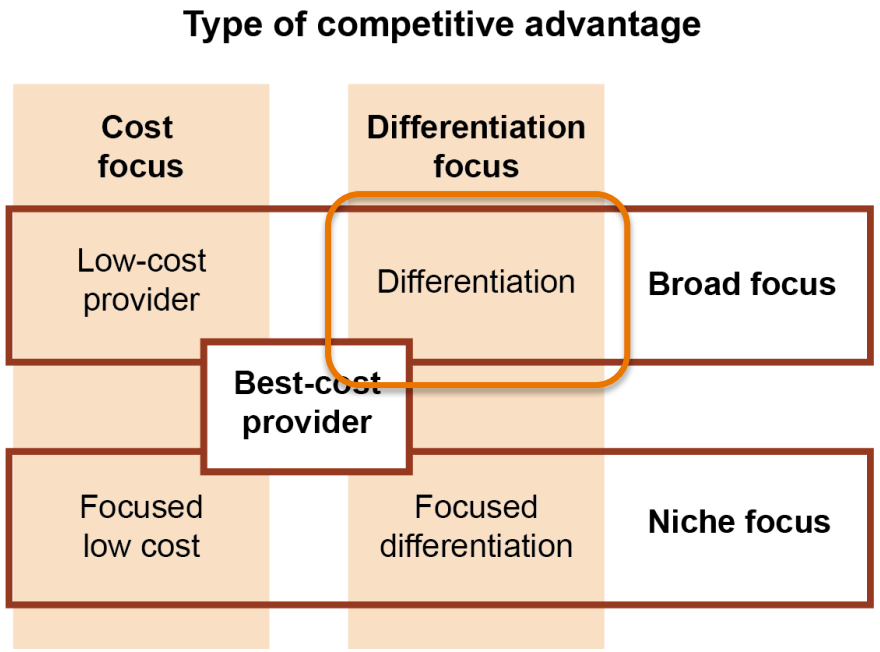
- Capture economies of scale.
- Omit needless processes.
- Focus on improvement and waste elimination.
- Utilize capacity without excess inventory.
- Lower supply chain costs.
- Negotiate for best prices.

Risks

- Erosion of profit margin as a result of price wars with competitors
- Easily imitated by rivals
- Vulnerability to sudden shifts in buyer preferences

Differentiation Strategy

- Communicate features and benefits rivals do not offer.
- Differentiation may vary:
  - Different capabilities (broader or more focused)
  - Level of customer service
  - Geographical area served



When favored

- Buyers have diverse preferences.
- Product can be changed meaningfully.
- Industry tech changes frequently.
- Few rivals are using this strategy.

Creating Differentiation and Related Risks

Creating differentiation

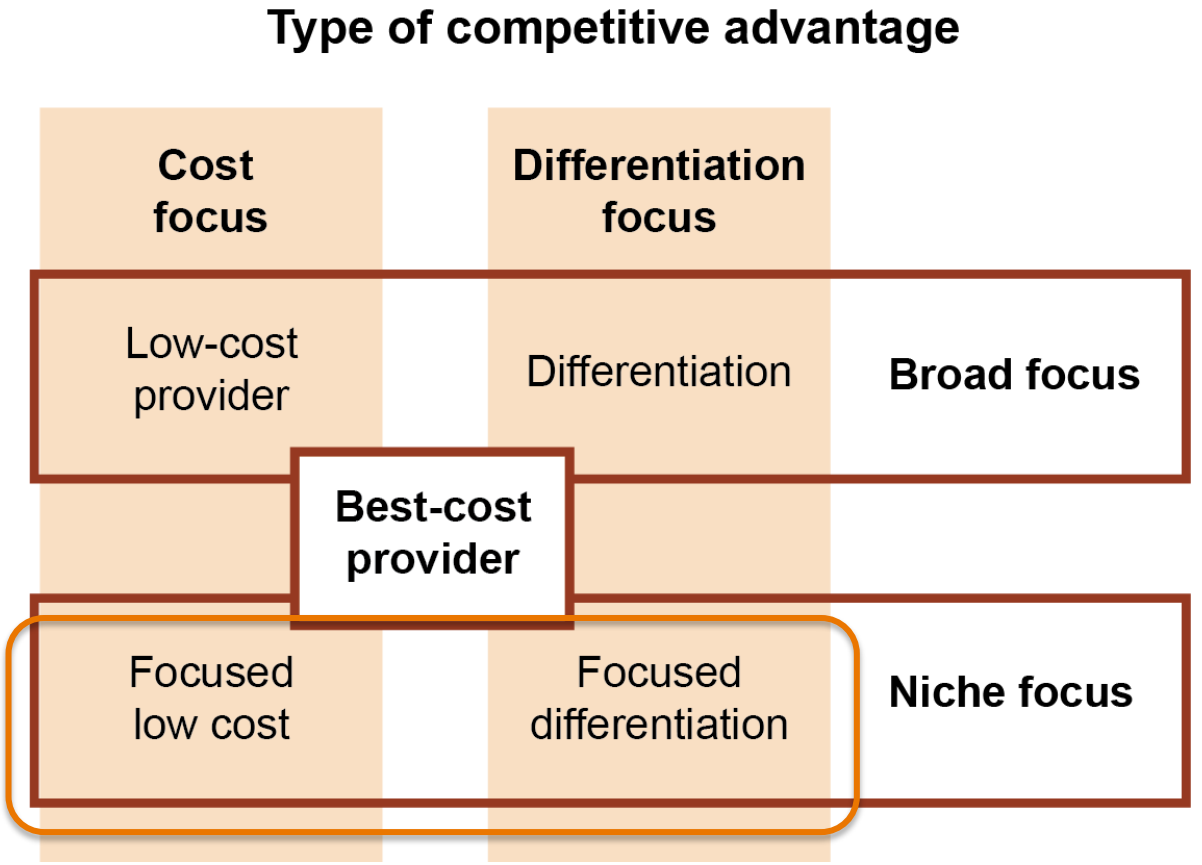
- Align value chain activities with targeted needs and preferences.
  - Exploit/build a strength.
- Work with supply chain partners. For example:
  - Design processes for speed.
  - Provide services to retailers to increase quality.

Differentiation risks

- Sudden change in customer needs or preferences
- Misunderstanding of buyer's perception of value
- Misunderstanding costs of delivering the differentiation
- Costly differences with no additional value to buyers

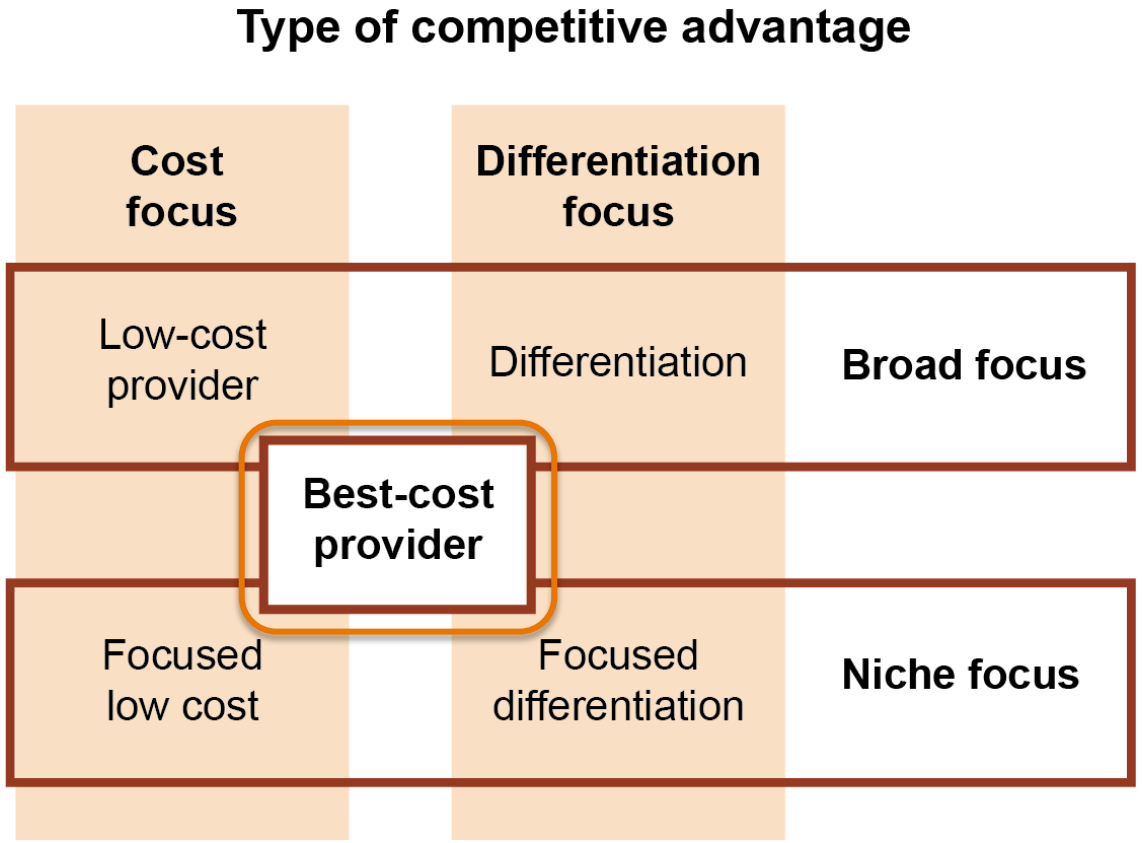
Focus Strategies

- Low-cost or differentiation applied to market niches—limits rivals
- Favoring
  - Large enough niche to create sufficient volume and profit
  - Few large, powerful rivals
  - Hard to imitate
- Risks
  - Niche shrinks.
  - Buyer preferences change.
  - Well-funded new rival enters market niche.



Best-Cost Provider Strategy

- Better low-cost alternative relative to competitors' offerings
- Mid-range products/services
- Must control costs and quality
- Conditions that favor
  - Value-minded buyers want quality and economy
  - Quality drops at lower prices
  - Increasing market prices
  - Good in recessions
- Risk of competitive attacks from low-cost providers and differentiated providers



Competitive Strategy Discussion

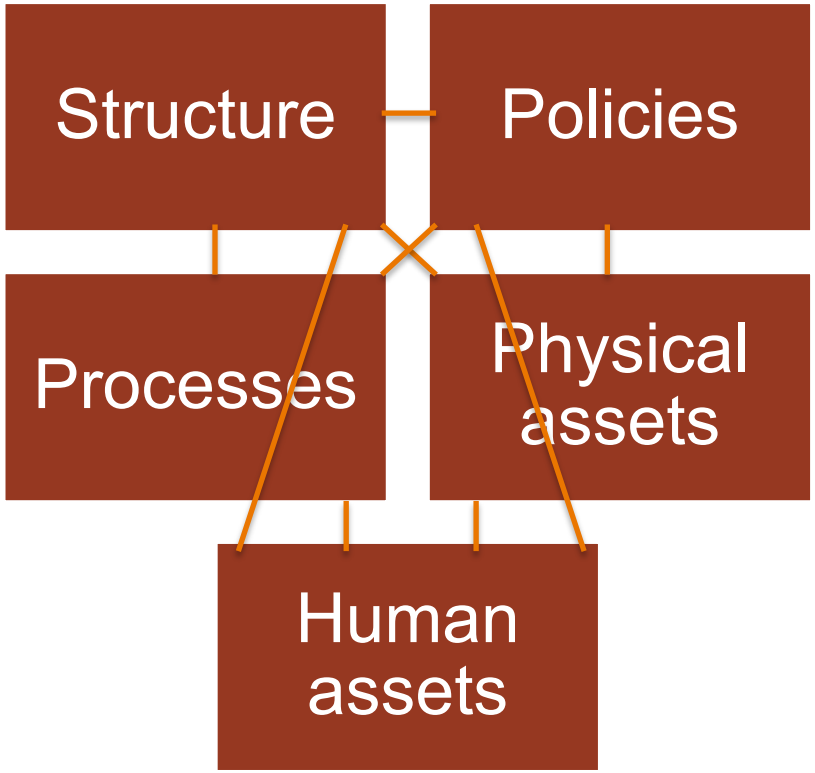
Scipa is a branded beverage company with a relatively large national market share. Its revenues are growing slightly faster than its rivals in a mature and slow-growing market. Like its rivals, Scipa has a very large marketing program, regional bottling operations, and diverse distribution channels.

Briefly assess Scipa's competitive environment based on the industry growth rate and market life cycle for its products.

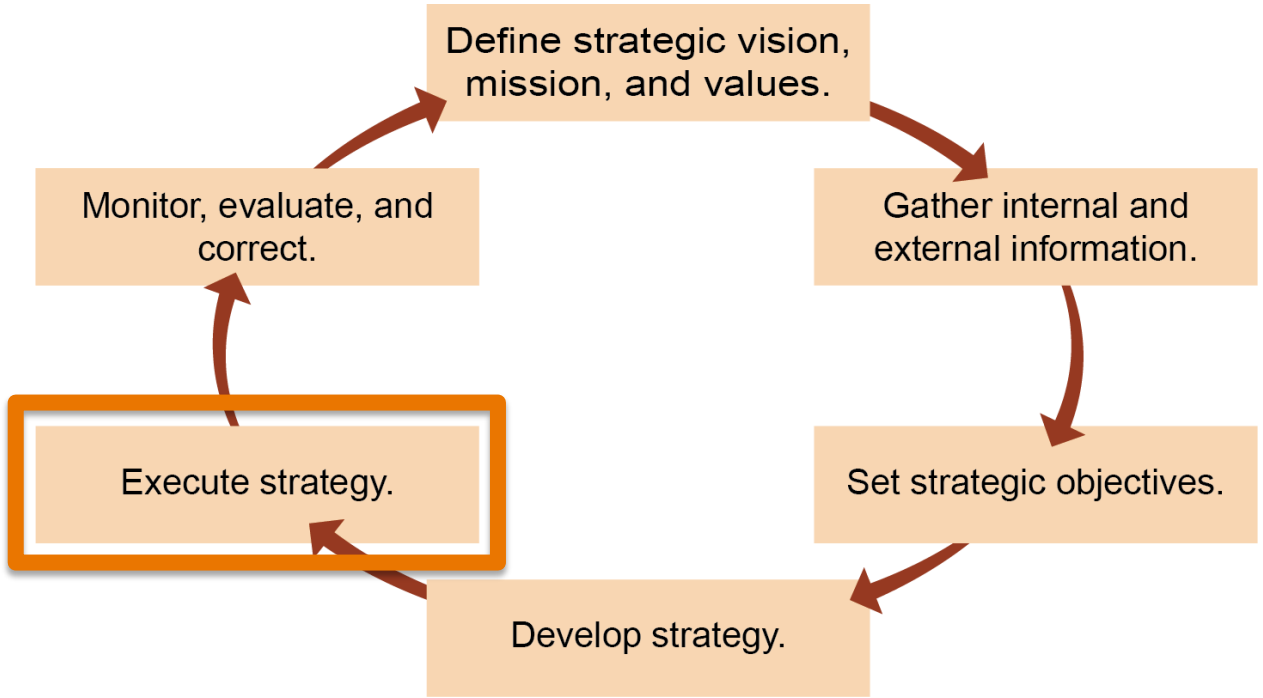
1. What are Scipa's likely competitive strategies?
2. What are the two most significant performance measures that relate to Scipa's competitive strategies, and why?

Executing Strategy

Execution elements



Align the organization's infrastructure to achieve its strategic goals



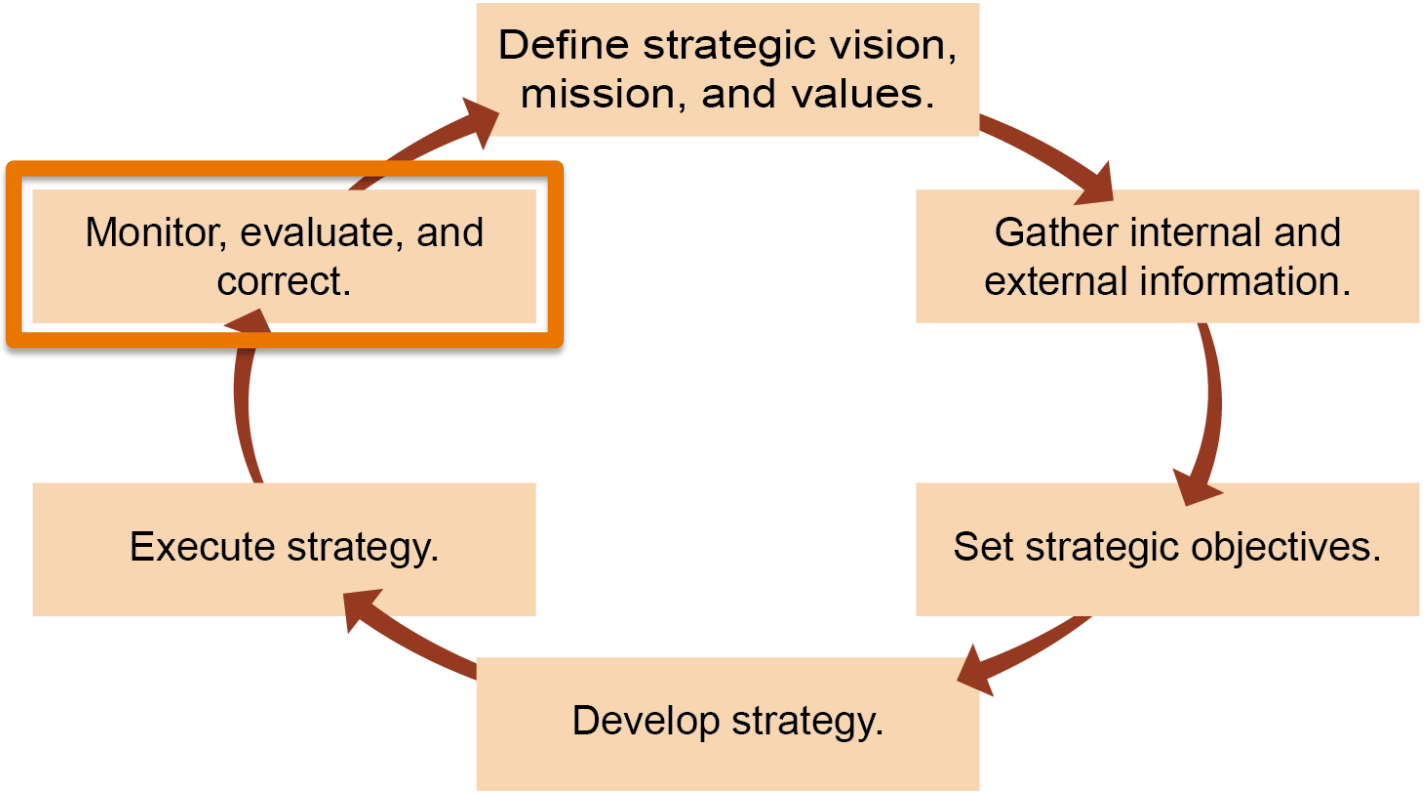
Monitoring, Evaluating, and Correcting Course

Strategies and tactics must be monitored:

Are strategies and tactics producing the intended results?

Do conditions still support the strategy?

What unintended results must be managed?



Kotter's *Accelerate:* Dual Operating System

Existing organizational structure + new network structure

Goal: Efficiency plus entrepreneurial energy and innovation

Hierarchical Structure Roles	Network Roles
Day-to-day affairs	Big opportunities
Extensions of current strategy	New strategies requiring speed and agility
Enabling continuous improvement and increased efficiency	Creating breakthroughs and large-scale change
Management	Leadership
Logic	Creativity

Dual Operating System Principles

- Broad internal team base.
- “Get to” rather than “have to” volunteering.
- Heart plus head.
- Leadership is the key.
- Inseparable left and right brains.

Big Opportunity and Eight Accelerators

1. Find big opportunities and create a sense of urgency.
2. Nurture new network of change agents.
3. Create a vision and focus on most-inspiring initiatives.
4. Create an army of volunteers.
5. Remove obstacles to progress.
6. Create quick wins.
7. Look for the next opportunity; find the next team.
8. Incorporate initiatives and institutionalize change.

Performance Objective Choices Exercise

Performance Objectives	Low-Cost Provider Strategy	Differentiation Strategy
Quality		X
Speed	X	
Dependability		X
Flexibility		X
Cost	X	

1. Explain your choice of key performance objectives for a low-cost provider strategy.
2. Explain your choice of key performance objectives for a differentiation strategy.

Objectives of Supply Chain Management Discussion

1. Describe at least two types of quality that are critical to supply chain responsiveness, and explain why.
2. What are two types of performance characteristics that relate to the performance objective of speed?
3. How does the dependability performance objective relate to cost?
4. What is the relationship between the performance objective of flexibility and a competitive strategy based on innovation and differentiation?
5. Name two types of cost reductions that are critical to a low-cost provider strategy.

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION D:
FUNCTIONAL AND OPERATIONAL STRATEGIES

APICS

ASCM

Section D Learning Objectives

- Operations strategy and the forces that shape it
- Organizational strategy
- Technology choices and cost, efficiency, and agility
- Manufacturing environments, process types, and technology
- Cost-volume-profit, target income volume, and sales mix analyses
- Capacity planning (including lead, lag, and tracking)
- 4Ps
- Make-or-buy decision
- Global facilities strategy and entering foreign markets

Functional and Operations Strategies

Functional strategy

"A strategy that is built from the business strategy for various business functions such as finance, marketing, and production."

Operations strategy

- Total pattern of decisions that shape long-term capabilities and contribution to overall strategy
- Should be consistent with overall strategy
- Distinct from operational management
  - Longer time frame
  - Broader perspective
  - Higher level of focus

Forces Acting on Operations Strategy

Key Areas in Operations Strategy

Process Technology and Assessments

Process technology

Priority	Technology Effects
Speed	Throughput and information sharing
Dependability	Coordination and feedback loops
Flexibility	Scale up/down without undue hardship; easy changeover
Quality	Standardization
Cost	Efficient/effective direct or indirect processes

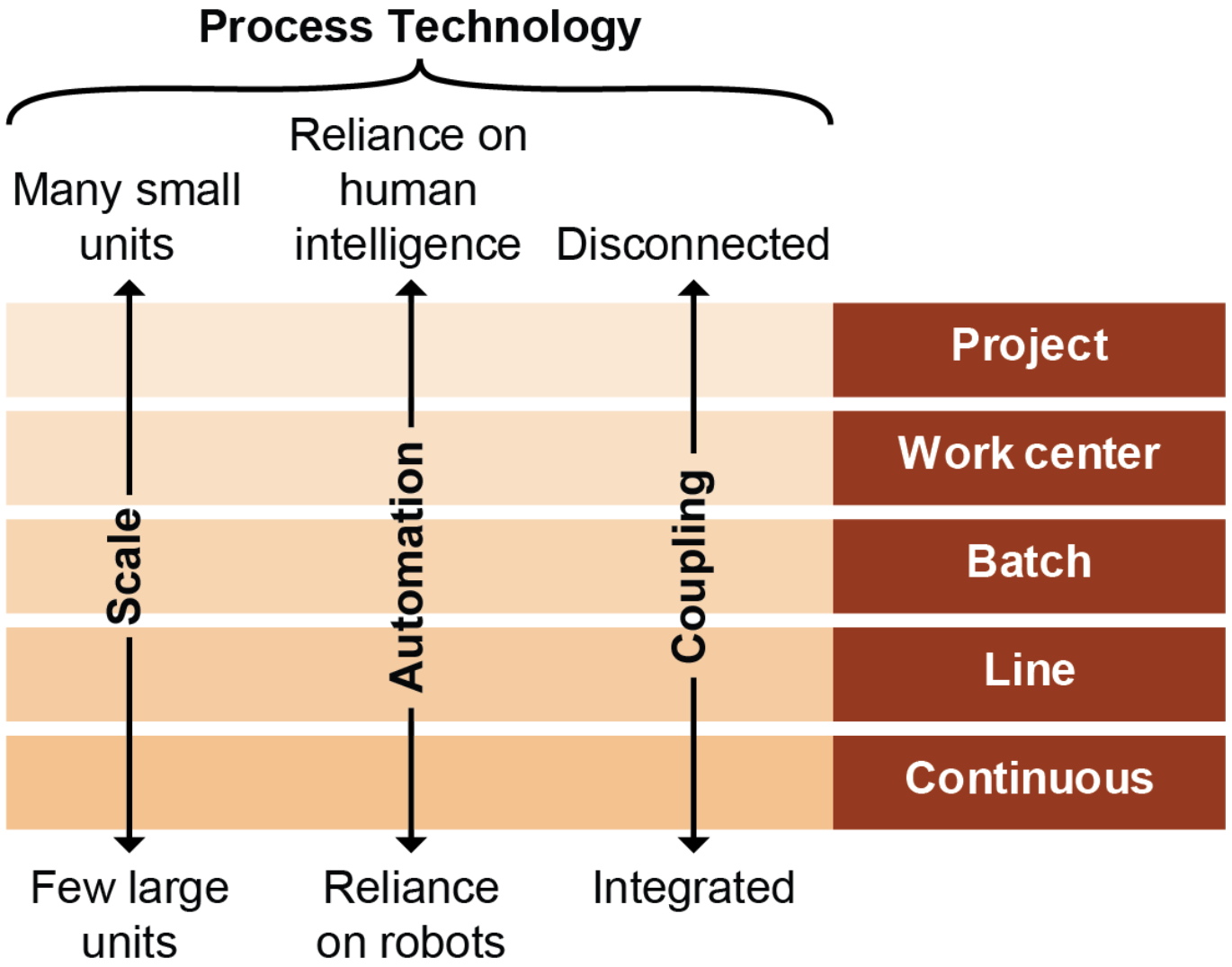
Evidence-based assessments

- Avoid “gut feelings” or bias toward new technologies without establishing need.
- Assess benefits and downside/risk.
- Gather data on improvements to speed, quality, etc.
- Assess financial impact (reasonable return, timing).
- Do pilot before committing.

Technology Road Mapping (Shipbuilder Example)

Goals	Year 1	Year 2	Year 3
Business	Meet technology initiative budget and schedule.	Meet utilization goals with QR and RFID blockchain tracking.	Break-even, analysis, messaging, asset optimization.
Product (i.e., ships being built)	Changes don't disrupt schedules.	Project change requests review asset availability.	Enable compressed schedules.
Process	Develop and train asset checkout and use process.	Develop and train predictive maintenance process.	Develop and train asset optimization process.
Equipment	Tag small assets with QR codes.	Tag big equipment with RFID.	Adjust equipment levels to demand.
Software	Blockchain MVP	RFID interfaces	Analytic interfaces

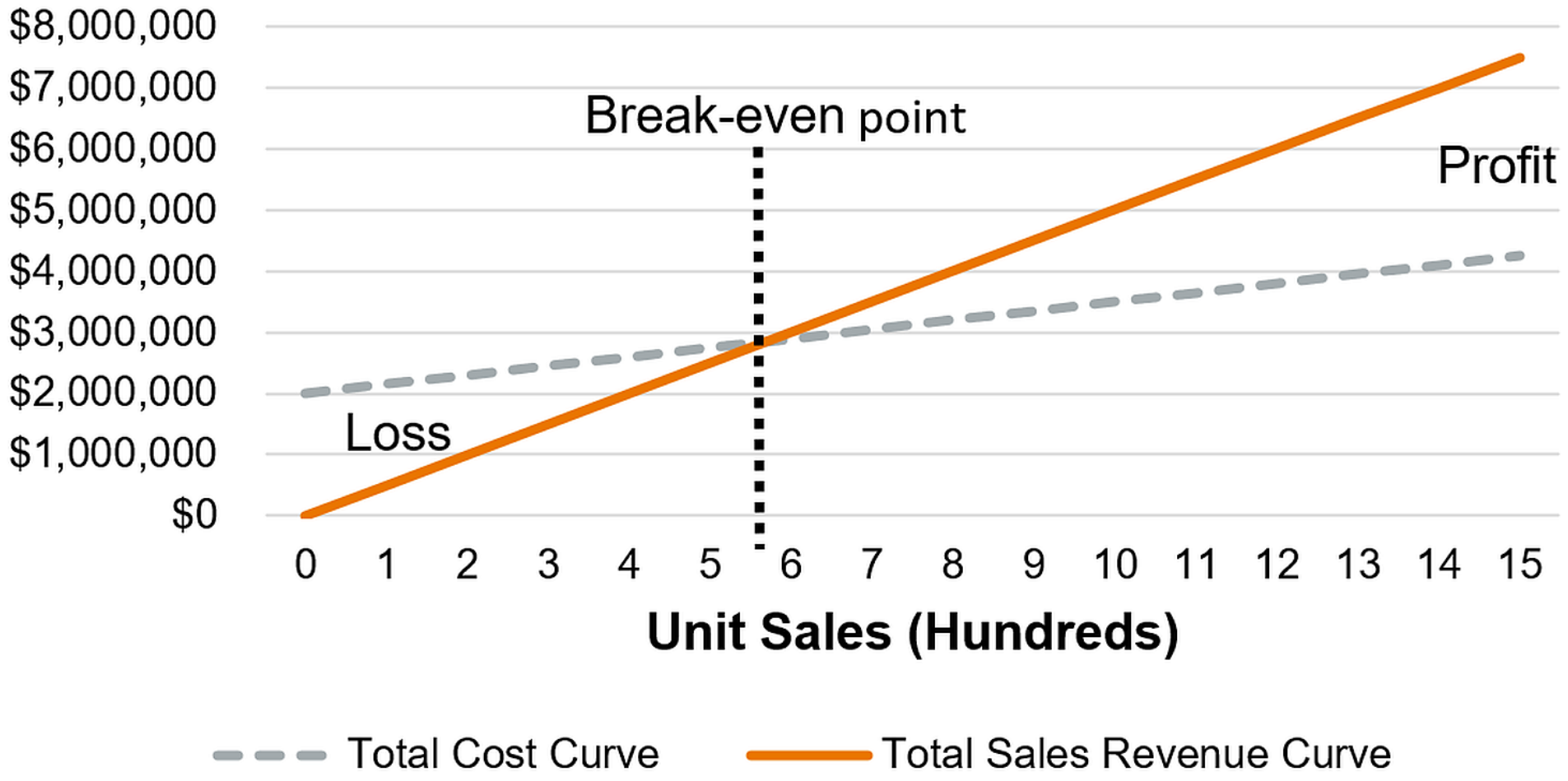
Process Technology and Process Types



Cost-Volume-Profit (CVP) Analysis

- "How profits change with various levels of output and selling price"
- A fixed or falling market price is the starting point. Then determine required cost and available profit.
- Clarifies effects of changes in
  - Sales
  - Production volumes
  - Costs
  - Price
  - Product mix.

CVP Analysis



Contribution Margin

"Difference between sales revenue and variable costs"; what is left to cover fixed costs.

Contribution Margin (CM) =
Sales – Variable Costs = $5M − $1.5M = $3.5M

Unit CM =
Unit Selling Price − Unit Variable Cost = $5,000 − $1,500 = $3,500

$$\text{CM Ratio} = \frac{\text{CM}}{\text{Sales}} = \frac{\$3.5\text{M}}{\$5\text{M}} = 0.7 = 70\%$$

Break-Even and Target Income Volume Analysis

- Break-even (B/E) analysis
  - Study of number of units or amount of time required to recoup investment

B/E Point (Units) =

$$\frac{\text{Fixed Costs}}{\text{Unit CM}} = \frac{\$2{,}000{,}000}{\$3{,}500} = 571 \text{ Units}$$

B/E Point (Dollars) =

$$\frac{\text{Fixed Costs}}{\text{CM Ratio}} = \frac{\$2{,}000{,}000}{0.7} = \$2.86\text{M}$$

- Target income volume analysis
  - Level of sales required to meet income goal

Target Income Volume Analysis =

$$\frac{\text{Fixed Costs + Target Income}}{\text{Unit CM}}$$

$$= \frac{\$2\text{M} + \$2\text{M}}{\$3{,}500} = 1{,}143 \text{ Units}$$

Sales Mix Analysis

Study of the effect of changes in the proportion of individual product sales that make up total sales

(in 000s)	Product A	Product B	Product C	Total
Sales	$5,000	$6,000	$2,000	$13,000
Sales mix	38.5%	46.2%	15.3%	100.0%
(Variable costs)	($1,500)	($2,000)	($750)	($4,250)
CM	$3,500	$4,000	$1,250	$8,750
CM ratio	70.0%	66.7%	62.5%	67.3%
(Fixed costs)				($2,500)
Net income				$6,250

Sales Mix Analysis

- What happens if sales of product C increase?
- Even if total sales remain the same, increased sales for product C result in decreased net income.

(in 000s)	Product A	Product B	Product C	Total
Sales	$5,000	$5,000	$3,000	$13,000
Sales mix	38.5%	38.5%	23.0%	100.0%
(Variable costs)	($1,500)	($1,667)	($1,125)	($4,292)
CM	$3,500	$3,333	$1,875	$8,708
CM ratio	70.0%	66.7%	62.5%	67.0%
(Fixed costs)				($2,500)
Net income				$6,208

Capacity Strategy and Planning

Capacity strategy

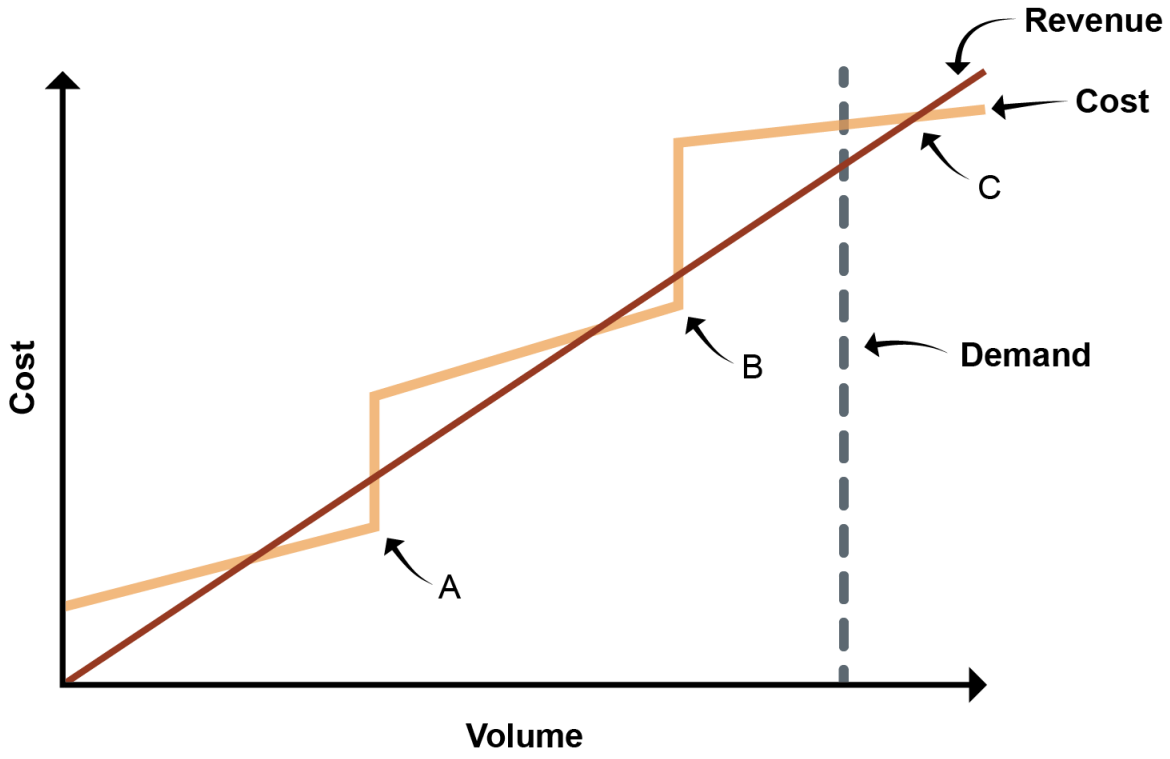
- A strategic choice made as part of manufacturing strategy.
- Capacity change strategies include
  - Lead capacity strategy
  - Lag capacity strategy
  - Tracking capacity strategy

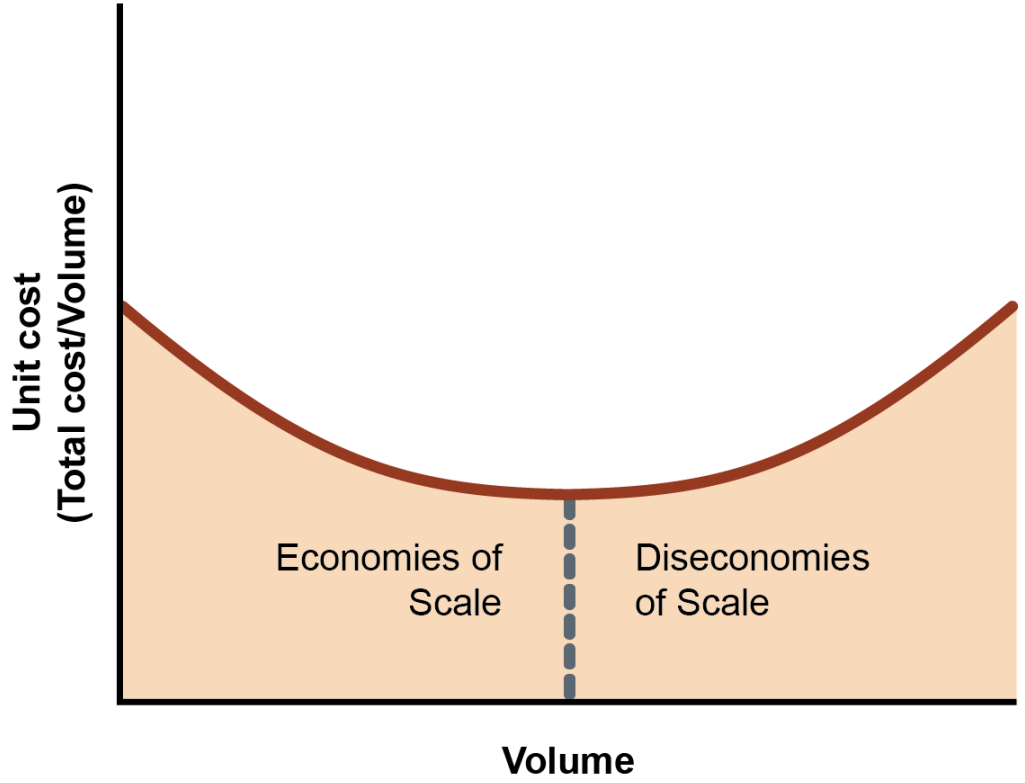
Capacity planning

- Estimating future capacity needs at various levels
  - Aggregate or product-line level for resource planning
  - Rough-cut capacity planning level for master scheduling
  - Detailed capacity requirements planning level for MRP

Factors Affecting Resource Planning

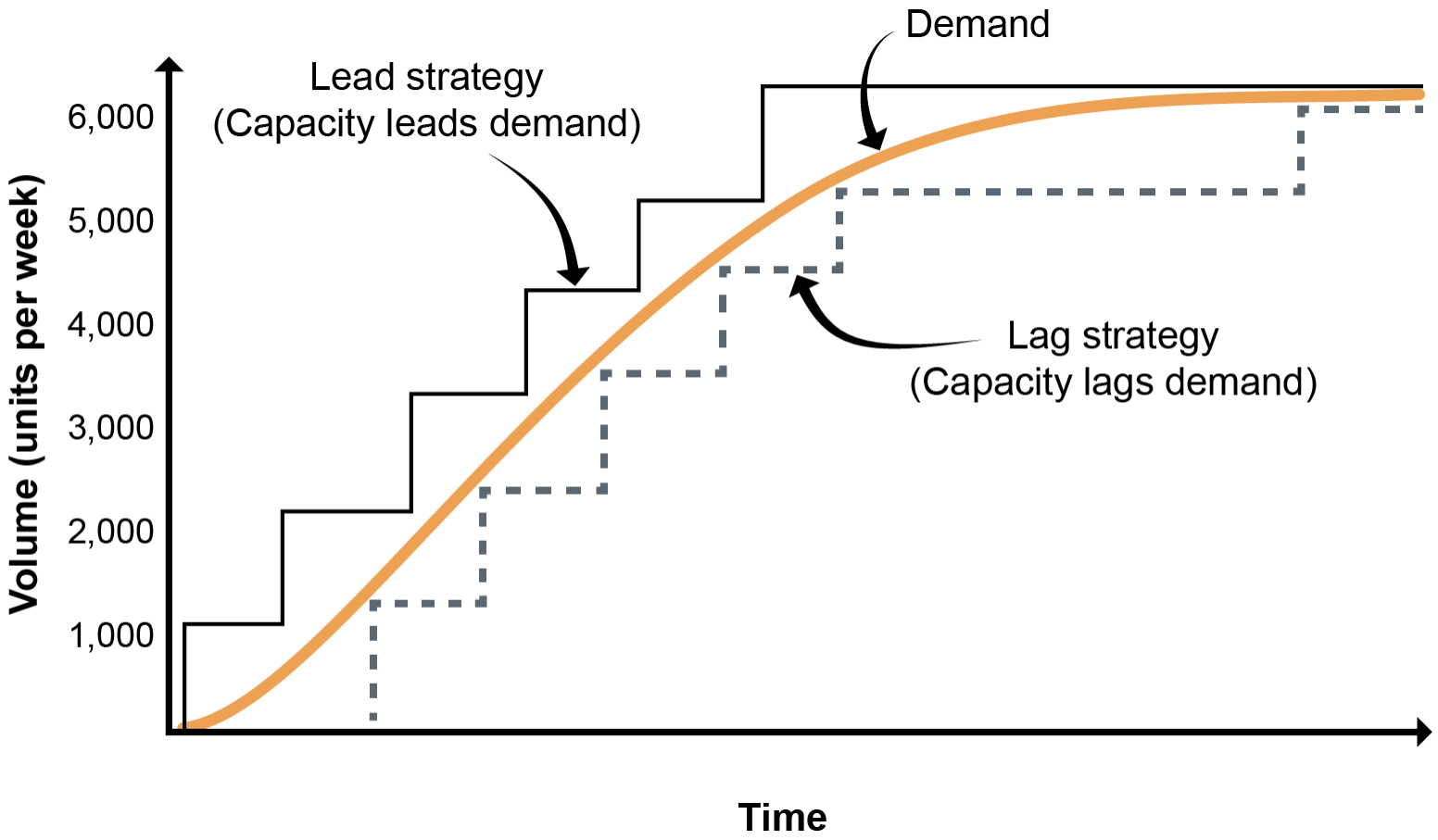
Increasing capacity, even flexibly, may have limits. Rising costs can change economies to diseconomies of scale.





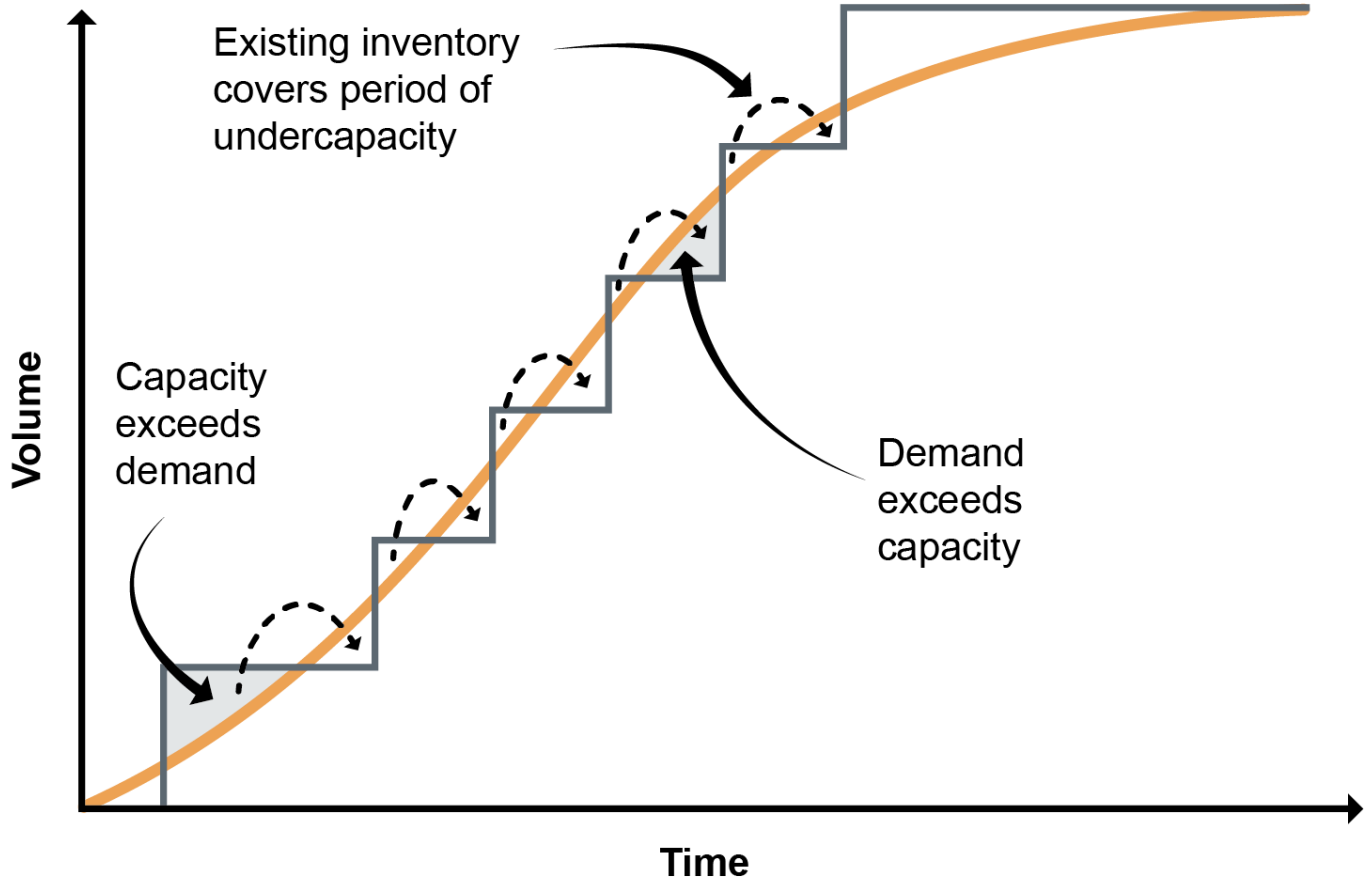
Changing Capacity

Timing of capacity change: lead and lag



Capacity Change

Timing of capacity change: tracking



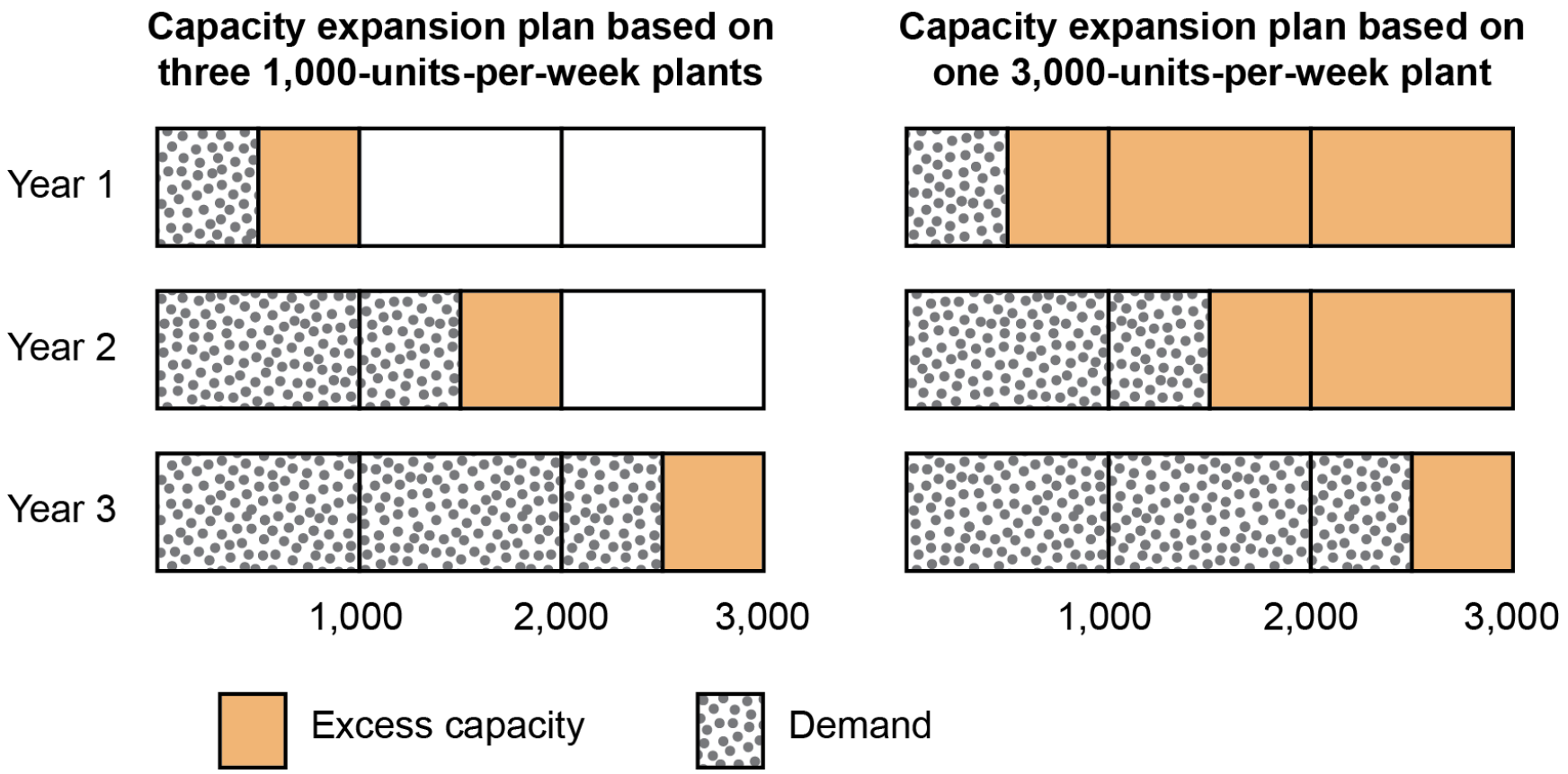
Advantages and Disadvantages

Approach	Advantages	Disadvantages
Lead	▪ Optimal revenue and customer satisfaction ▪ Output cushion to accommodate unexpected events	▪ Earlier timing for cash outflow ▪ Risk for overcapacity
Lag	▪ Lower unit costs	▪ Risk of lost revenue and customers ▪ No cushion
Tracking	▪ All demand satisfied ▪ Lower unit costs ▪ Moderately flexible	▪ Higher cost of inventory ▪ Inventory loss risk

Lead and Lag Capacity Exercise

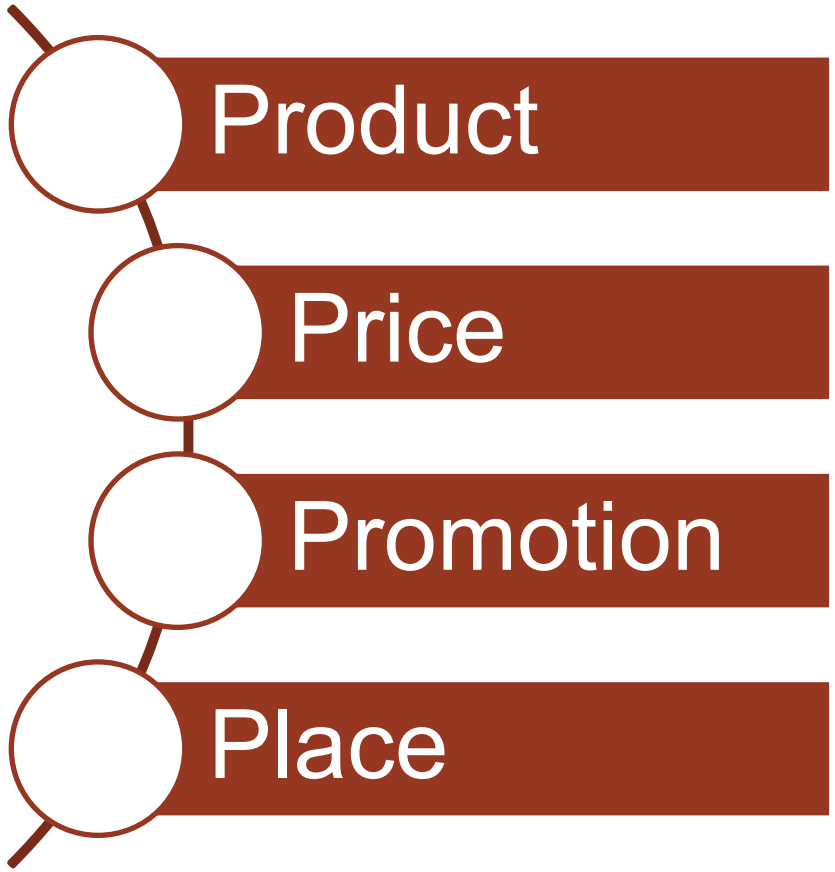
Characteristics	Lead Strategy	Lag Strategy
Low risk of temporary capacity insufficiency	X	
High plant utilization percentage		X
Cushion against pessimistic forecast error	X	
Delayed capital spending		X
Low risk of permanent overcapacity		X
Low unit cost of production		X
Customer satisfaction	X	
Revenue maximization potential	X	
Flexibility to meet unexpected demand	X	
Smoothing of inventory levels	X	

Planning Increments of Capacity Change

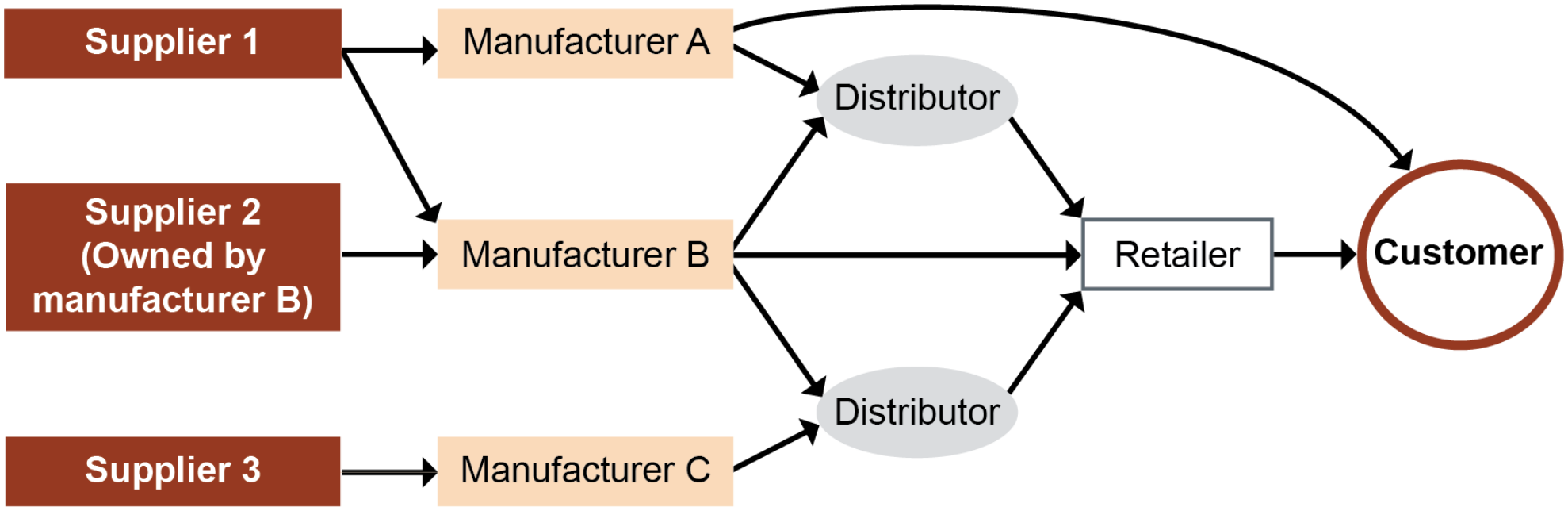


Marketing Strategies

- Ads, trade discounts, and sales force incentives to generate demand
- If demand is greater than supply:
  - Marketing: Higher price or longer lead time
  - Operations: Production flexibility or inventory holding

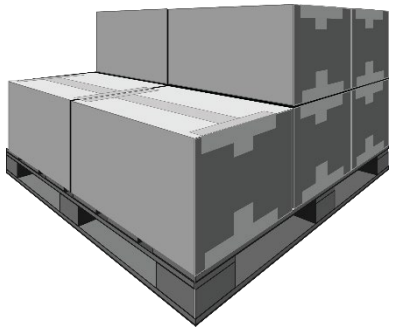


Supply Chain Network Design

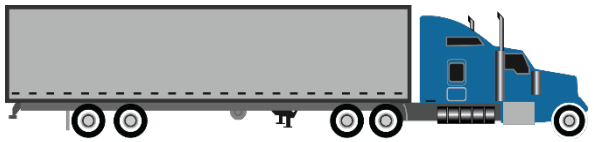


Functionally Oriented Organizations

Raw materials



Department incentives: Maximize own metrics at expense of others.



Purchasing

- Lowest price
- Inventory buffers

Manufacturing

- High utilization
- Long runs (few setups)
- Low cost per unit
- Safety stocks

Distribution

- Full truckloads
- Lowest shipping rate
- Safety stocks

Customers

Adversarial buying

Inflexible

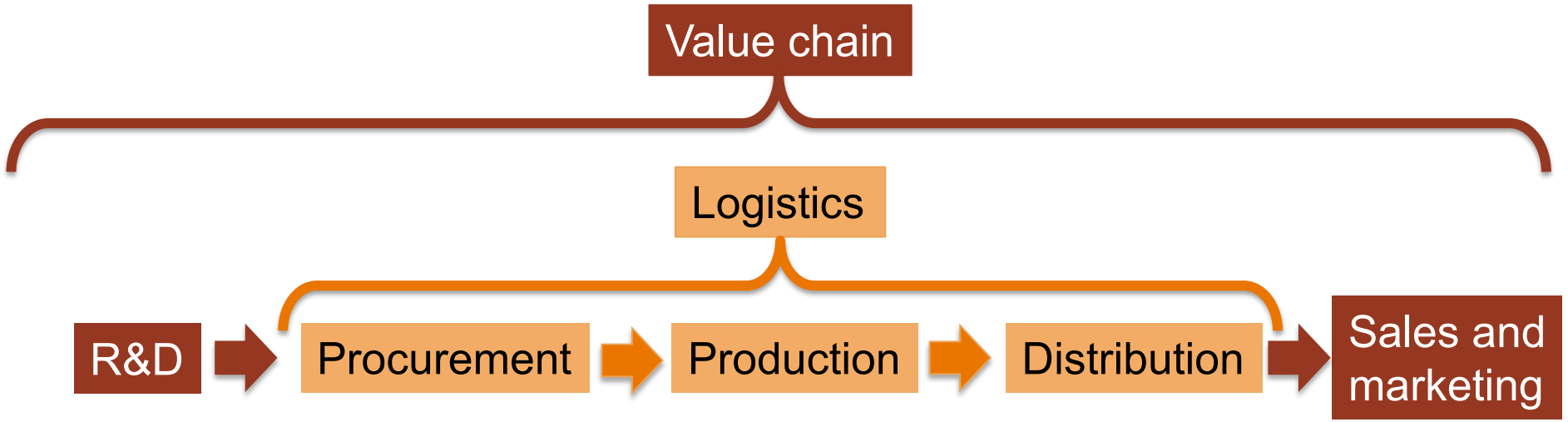
High inventory cost

Tradeoffs in Functionally Oriented Organizations

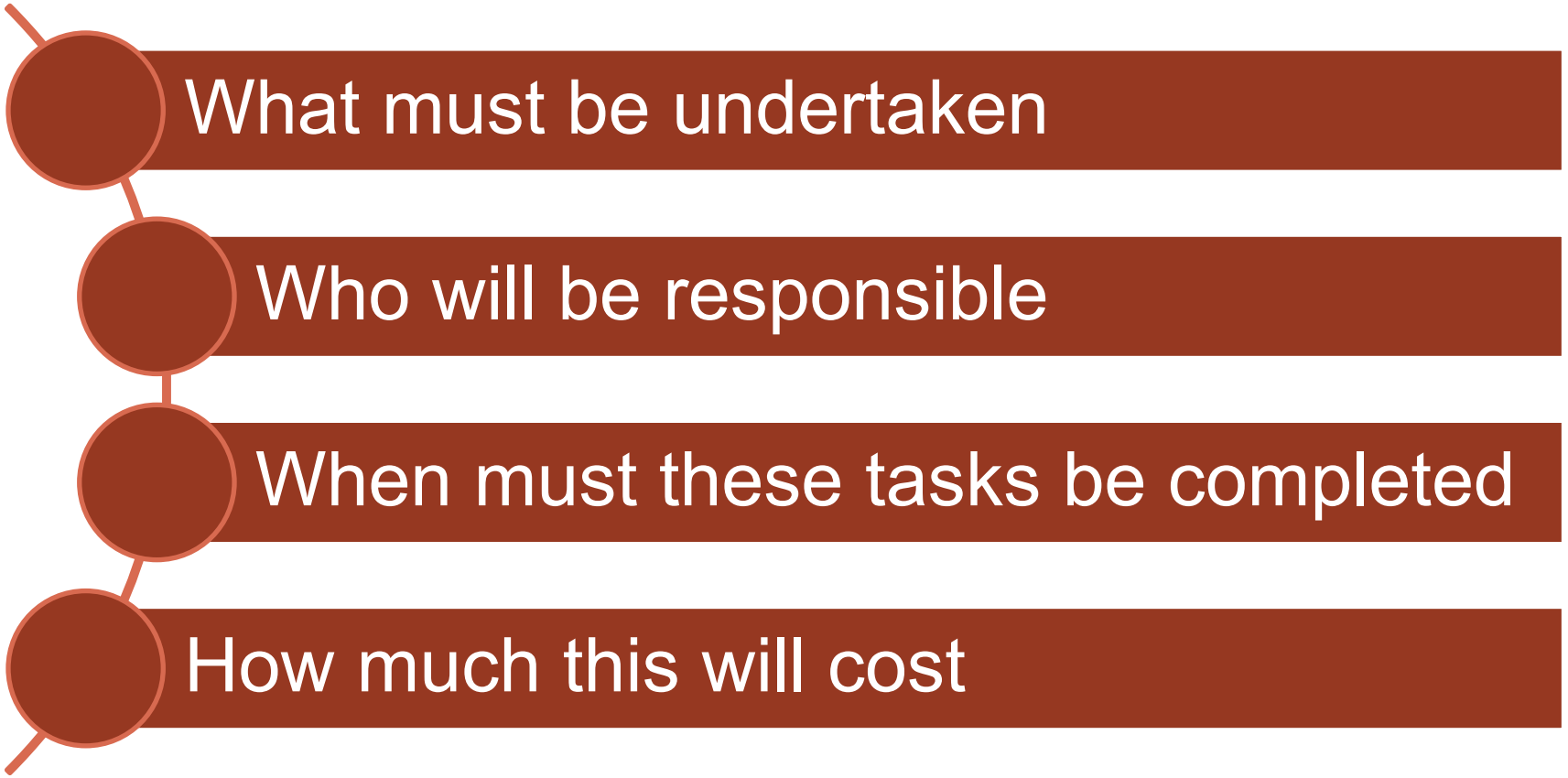
Functional Area	Objectives	Supply Chain Tradeoffs Results
Operations	▪ Materials available ▪ Reduced setup costs ▪ Reduced cost/unit and high economies of scale ▪ Maximized labor and equipment utilization ▪ Stable production schedules	▪ Safety stocks ▪ Inventory increased by long runs, few changeovers; risk of stockouts of other items ▪ Buffer inventories for high utilization ▪ High inventory ▪ Less responsive to order changes
Sales and marketing	▪ Maximized sales ▪ Satisfied customers ▪ Flexible product mix	▪ Safety stocks ▪ High inventory in distribution system ▪ Changes to production as orders change
Finance	▪ Maximized profit ▪ Rapid cash flow ▪ Minimized assets	▪ Promotion of customer service and production efficiency… ▪ …But with low safety stocks or other inventory

Cross-Functional Organizations

Risk management is necessary throughout the value chain due to the complexity of the involved systems.



Operational Plan



Details of Operational Plan

Design

- Select products.
- Manage development.
- Make or outsource design.

Delivery

- Monitor and adjust to demand levels.
- Processes to buy/make and deliver products.

Development

- Measure and report performance.
- Continuously improve performance.
- Assure quality.

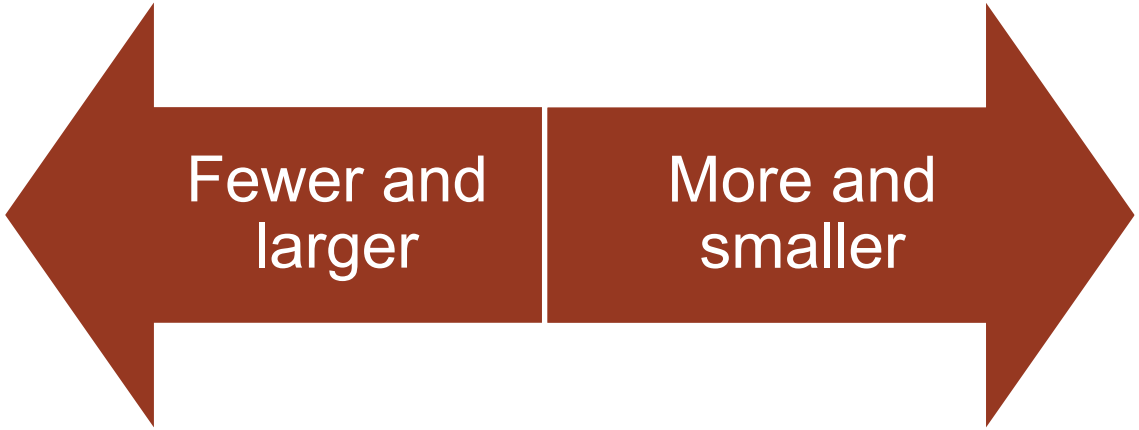
Make-or-Buy Decisions

Make it.	Think carefully.	Buy it.
▪ Strategic importance. ▪ Specialized knowledge/skills. ▪ Will increase core competencies.	▪ Not strategic but could pose risk to operations performance objectives.	▪ Supplier has unique capabilities that buyer does not possess. ▪ Supplier can improve operations performance.

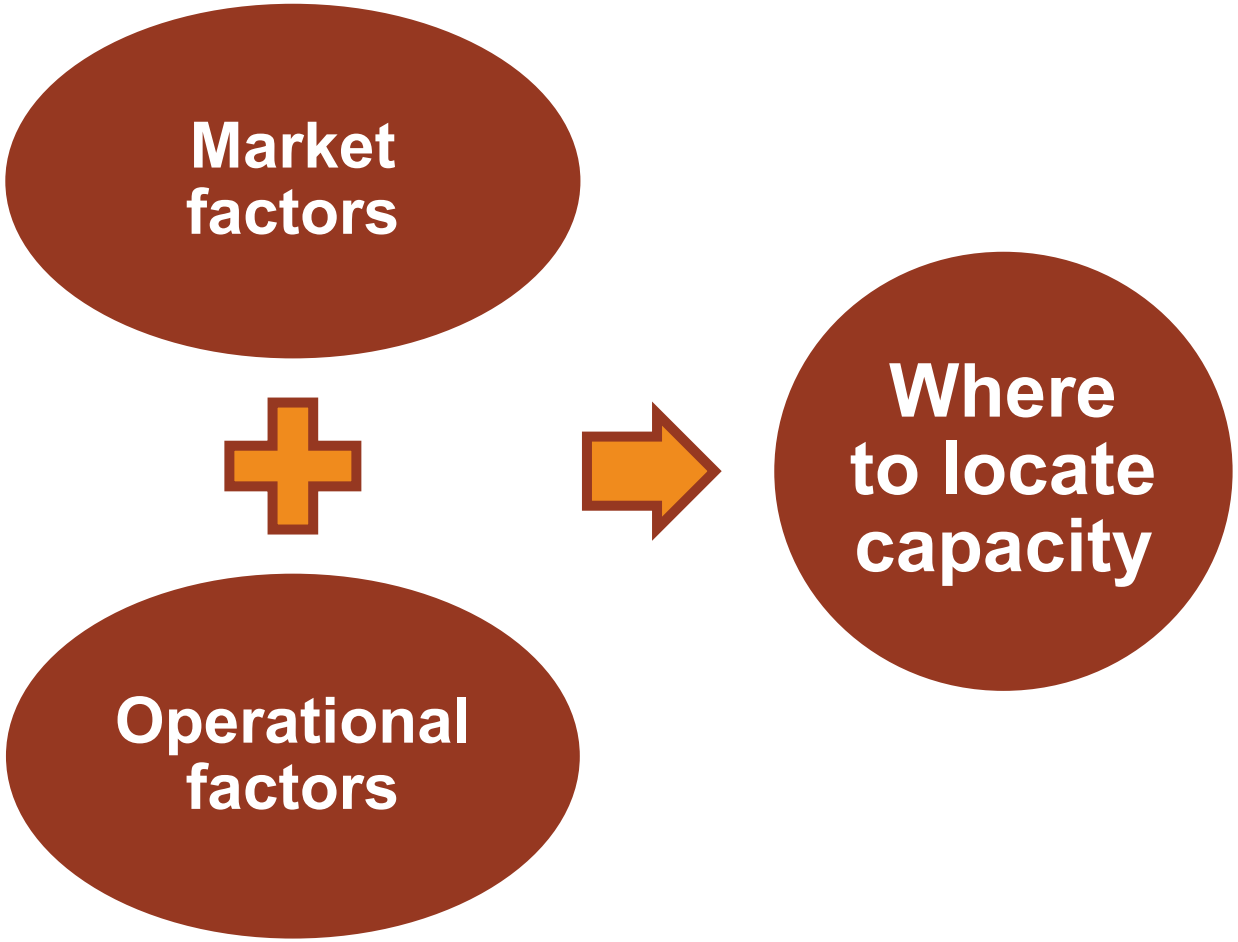
Number and Size of Sites

- Less costly to operate due to economies of scale
- Less costly to supply centralized locations

- Increased customer responsiveness
- Decreased cost of transportation to customers



Locating Capacity



Number and Size of Sites Exercise

Decision Factors (X indicates advantage in a few large sites or many small sites.)	Market Area Served by:	
	Few Large Sites	Many Small Sites
Economies of scale	X	
Transportation costs		X
Customer service		X
Sales volume		X

Number and Size of Sites Discussion

1. Explain the relationship of the number and size of manufacturing sites to transportation costs.
2. What effect will adding retail sites in a regional market have on customer service, and why?
3. Explain the relationship in a regional market of the number of retail sites to sales volume.
4. What different performance objectives do a few large sites versus many small sites relate to?

Global Strategies: Locating Value Chain Activities

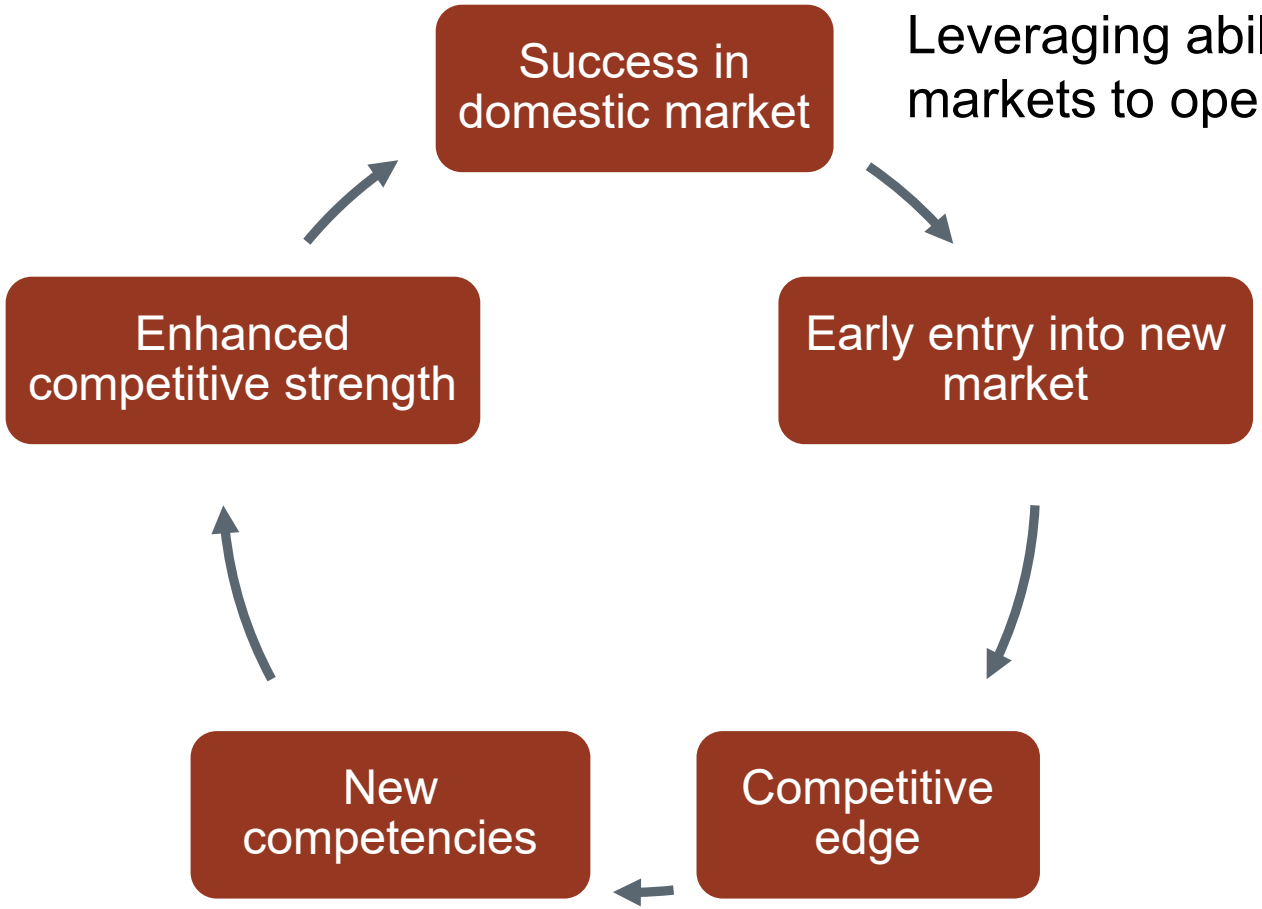
Advantages of widespread dispersal

- Firms with many global markets can deliver faster service from distribution centers near customers.
- Diversification reduces risk of interruption or impact of currency fluctuation.

Advantages of focused location

- Local production advantages that outweigh transportation cost.
- Economies of scale from a few large centers.
- Learning curve effects minimized.
- Better coordination with large suppliers and customers.

Global Strategies: Domestic Competencies in New Markets



Leveraging abilities in domestic markets to open new markets

Ways to Enter Markets

Entry Option	Some Advantages	Some Disadvantages
Export	Minimal investment and maximum control	Costs of shipping and currency fluctuation
Licensing	Low investment and income from royalties	Loss of proprietary knowledge
Franchising	Lower costs and income from franchising fees	Damage to brand and identity
Subsidiary	Control over business and profits	Significant investment and risk of cultural conflicts
Strategic alliance/joint venture	Combined competitive strengths and organizational learning	Less control, more conflicts, loss of proprietary information

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION E:
ENVIRONMENTS, TYPES, AND LAYOUTS

APICS

ASCM

Section E Learning Objectives

- Push-pull decoupling location and best manufacturing environment
- Forecast-driven versus demand-driven strategies
- Impact of volume and variety on technology decisions
- Tradeoffs in product-process matrix and service design matrix
- Layout choices
- Processes, layouts, and product/service life cycles

Push-Pull Operational Strategies

Forecast-driven enterprise

- Schedules based on forecasts
- Unstable demand
- Bullwhip effect is an issue
- Addressing bullwhip effect
  - Better visibility in both directions, especially regarding promotions
  - Rely less on forecasting

Demand-driven enterprise

- Demand-driven supply network (pull system)
  - Goals: reduce inventory, maintain customer satisfaction
- Demand-driven planning
  - Demand-driven materials requirements planning (DDMRP)
  - Dynamic strategic inventory buffers

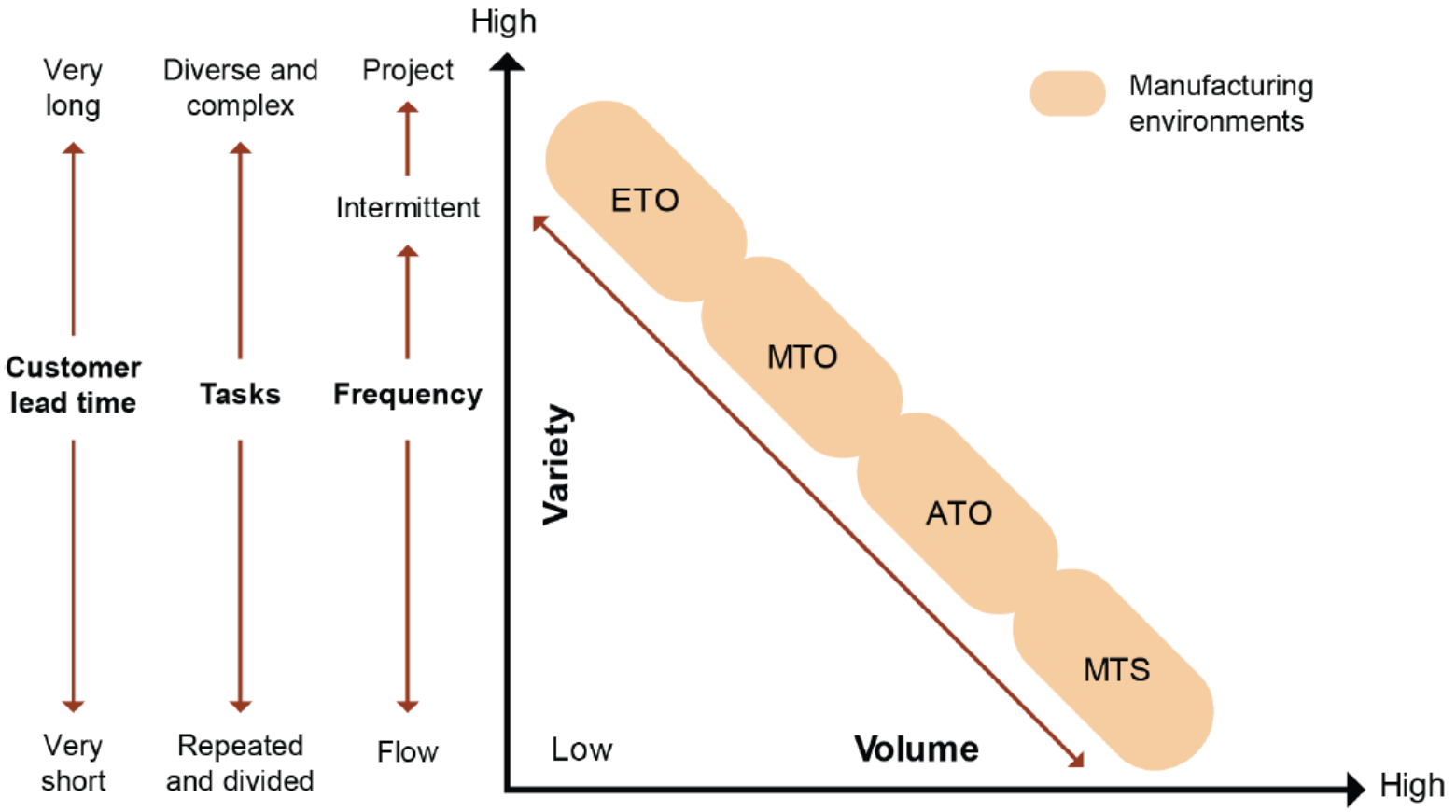
Manufacturing Environments

	Information	Planning	Control
ETO	Engineering design and feasibility	Detailed engineering design and project management	Adjust capacity to customer needs.
MTO	Product specifications and costing	Engineering and manufacturing capacity	Adjust configurations to customer needs.
ATO	Configuration management	Available options and lead time quotation	Meet manufacturing schedule and delivery dates.
MTS	Forecast reliability	Inventory levels	Ensure customer service levels.

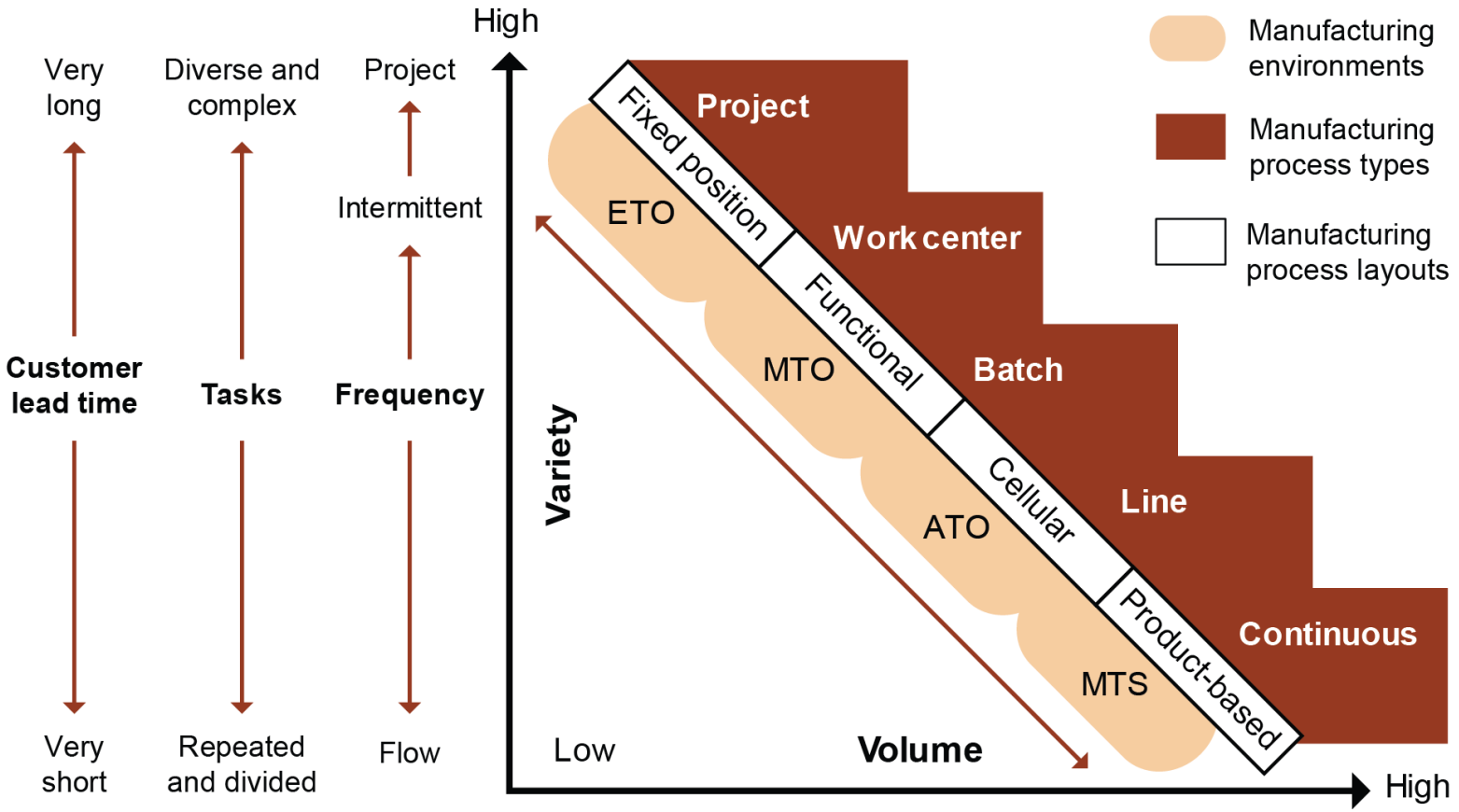
Hybrids and Subtypes

- **Configure-to-order:** Make components after order, so same lead time as MTO.
- **Mass customization:** Customize at near same cost as high-volume process.
- **Postponement:** Delay final differentiation (e.g., at distribution center) for less inventory, faster response.
- **Modular design:** Standardization into modules; more design expense but simpler assembly/maintenance; basis for ATO.
- **Package-to-order:** Bulk storage until order.
- **Remanufacturing:** Restoring product to like-new condition.

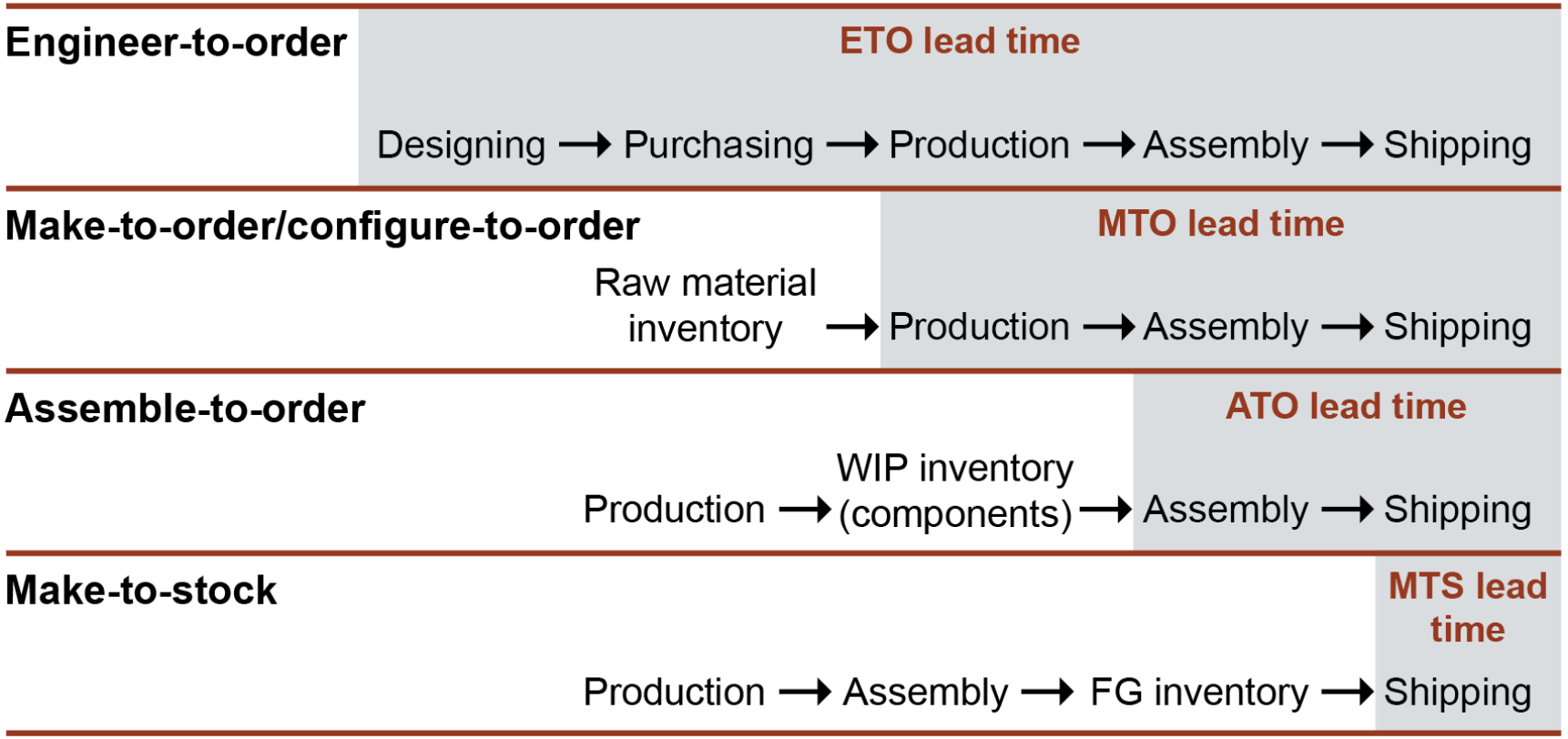
Product-Process Matrix and Manufacturing Environments



Environments and Process and Layout Choices



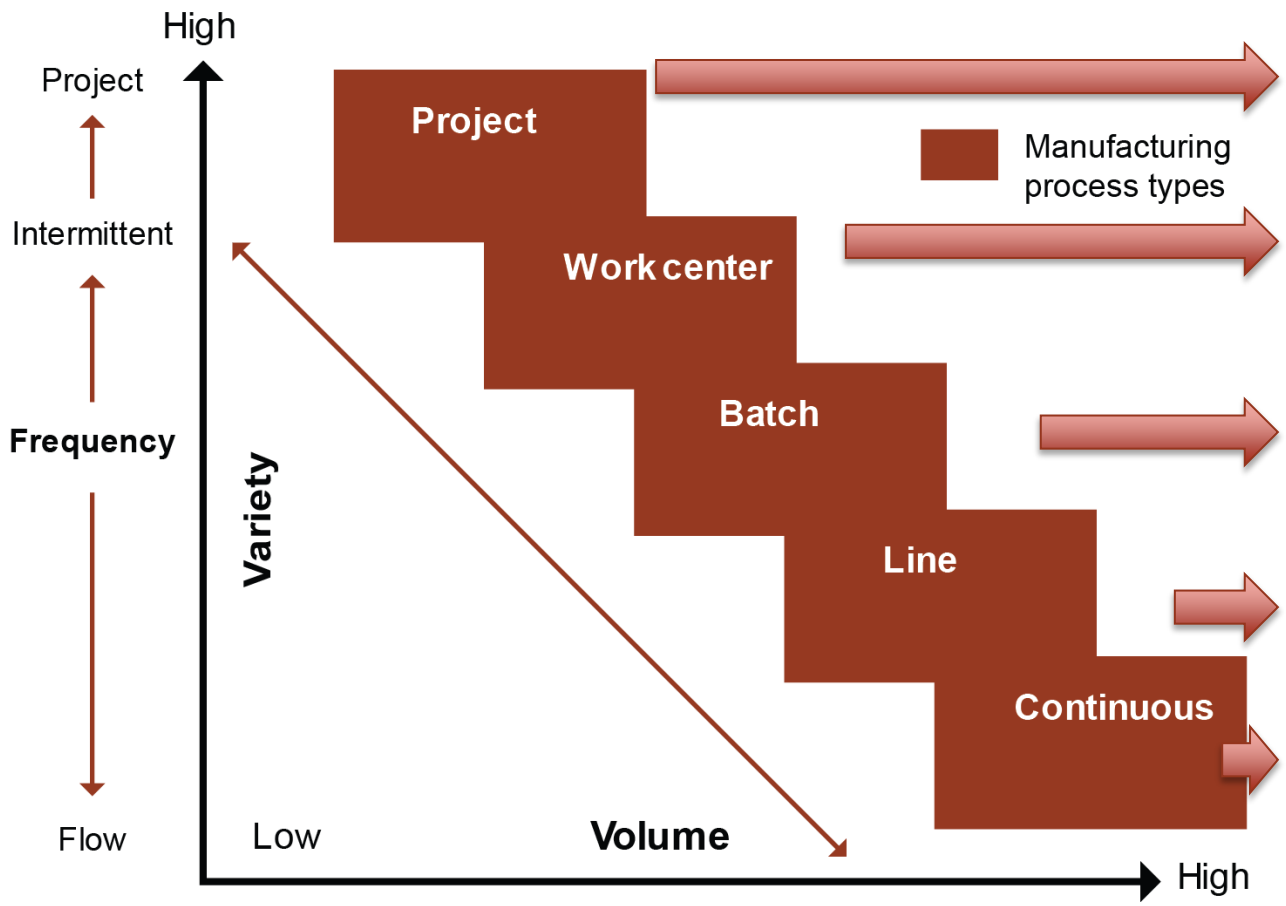
Lead Time per Manufacturing Environment



Common Manufacturing Environment Characteristics

Environment	Volume	Variety	Design	Cycle Length
ETO	Low	High	Unique	Longest
MTO	Medium-low	Medium-high	Unique configuration of standard or custom features	Long
ATO	Medium-high	Medium-low	Customized configuration of standard components	Medium
MTS	High	Low	Fixed but with many stockkeeping units (SKUs)	Shortest

Manufacturing Process Type Comparison



- Dedicated work centers with highly skilled workers; intermittent flow
- Work centers grouped by common function; intermittent due to custom orders and routing
- Grouped by function or cell; higher volume and longer queue; moderate skill level
- High volume; controlled rate; medium to low skill level
- Dedicated work centers, end to end; inflexible; precision required

Project Process Type

- Projects must have unique deliverables (large and complex) and a deadline.
- Control:
  - Time
  - Cost
  - Scope (what will and will not be done)

Intermittent Process Type

- Varied routings and lots
- Unbalanced workflows
- High WIP, lead times
- Complex MPC (bottlenecks)
- Flexible equipment/labor

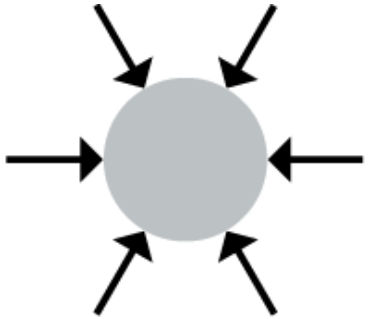
- Work center (job shop)
  - Smaller lots
  - Need fast setups
- Batch (batch flow or lot)
  - Longer runs, fewer setups
  - Shorten moves

Flow Process Type

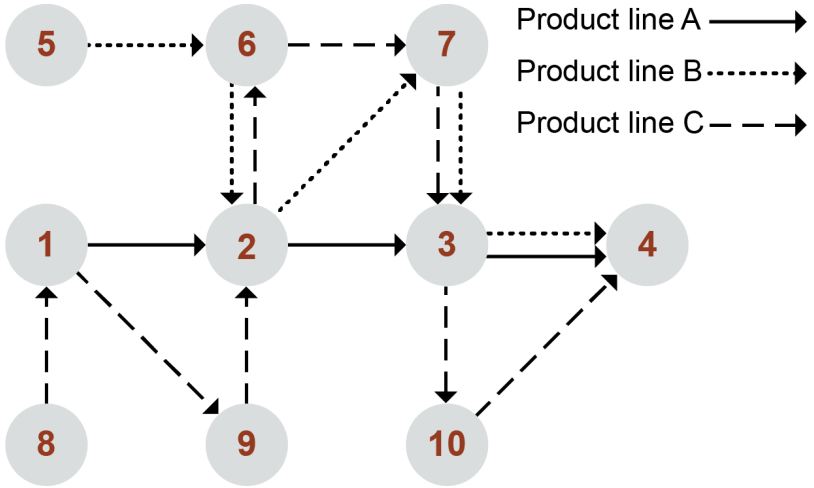
- Standardized products with devoted lines
- Nearly constant rate, so low WIP and short lead times
- Specific products only (New products need new lines.)
- Hard to change; volume must justify high capital cost
- Line process type: discrete units
- Continuous process type: liquids or bulk solids

Process Layouts

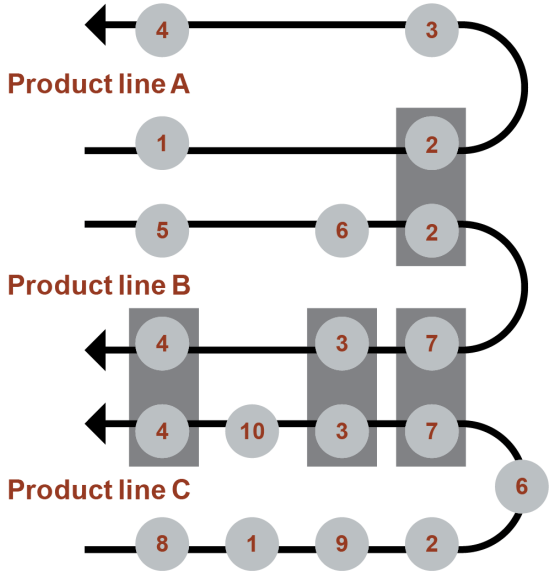
Fixed



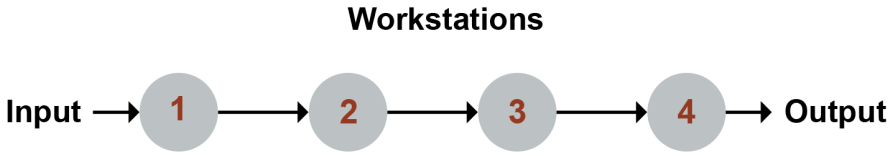
Functional



Cellular

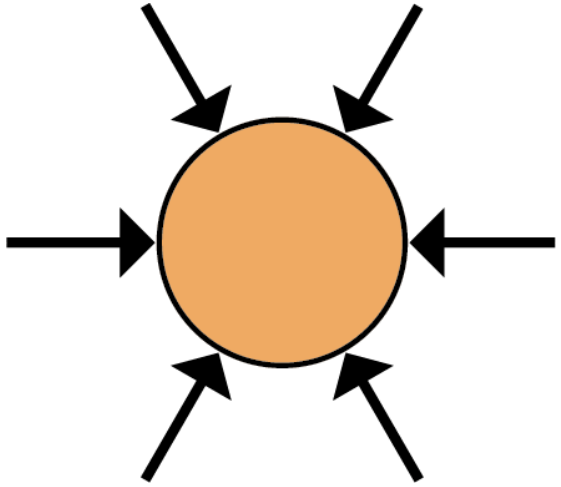


Product-based



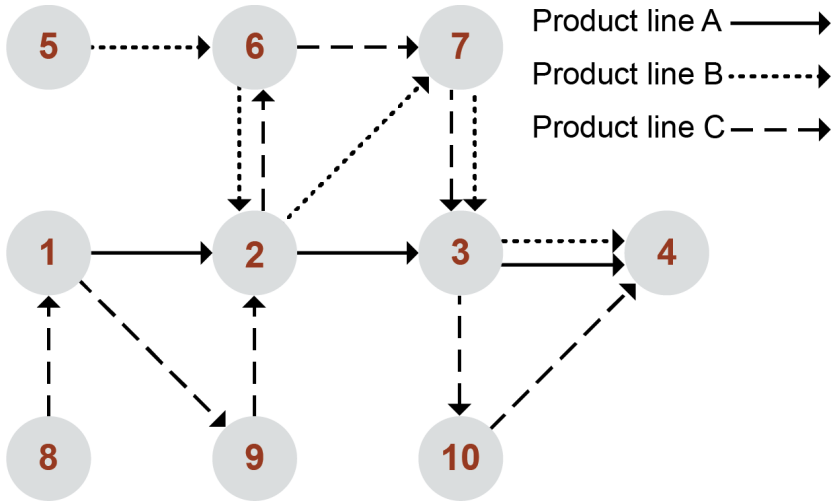
Fixed-Position Layout

Benefits	Limitations
▪ High independence of production centers. ▪ High flexibility and adaptability. ▪ Low capital investment. ▪ Low amount of material movement.	▪ High effort when moving machines to product location. ▪ Highly skilled labor is needed. ▪ Limited storage space for materials.



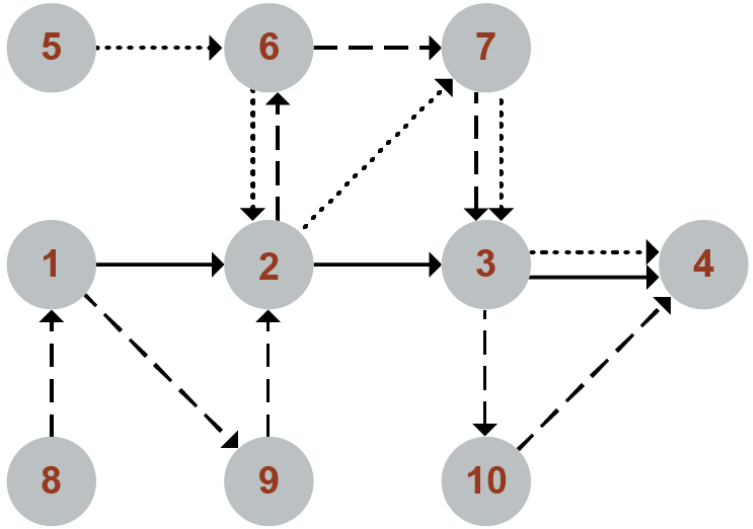
Functional Layout

Benefits	Limitations
▪ High equipment flexibility and need for fewer machines. ▪ More specialized supervision. ▪ Ability to transfer work leads to low risk for loss of production due to machinery breakdowns.	▪ Queue time leads to higher total production time. ▪ Bottleneck potential is high. ▪ Higher handling costs due to longer product flow line.

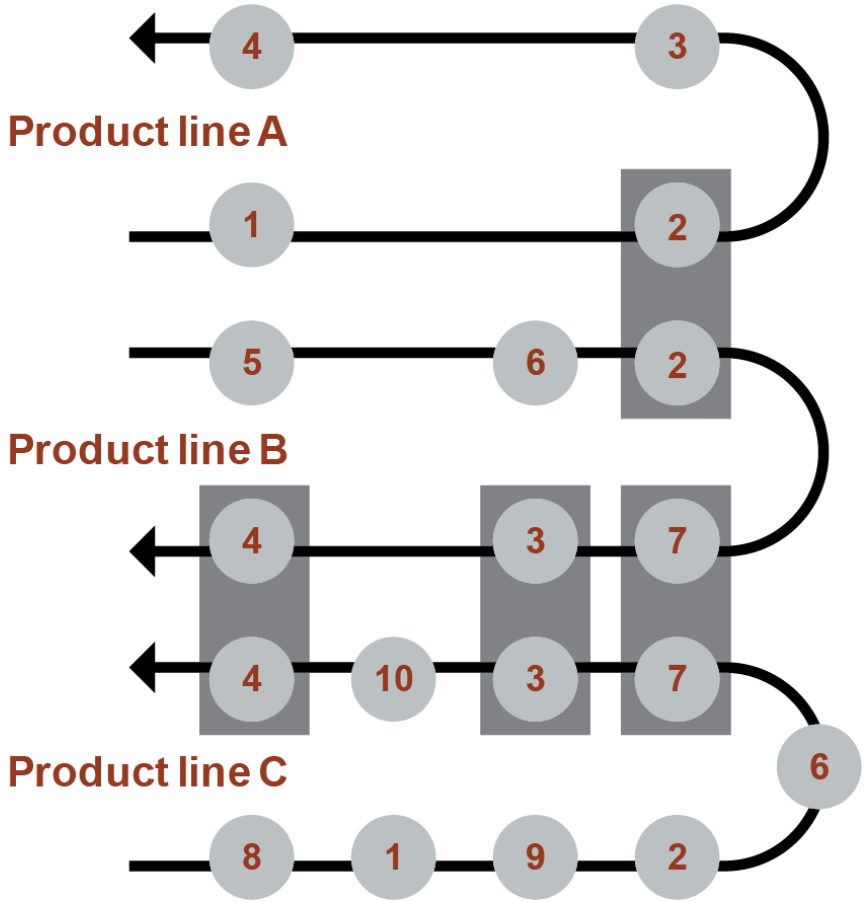


Cellular Layout

From this functional layout…



To these cellular layouts…

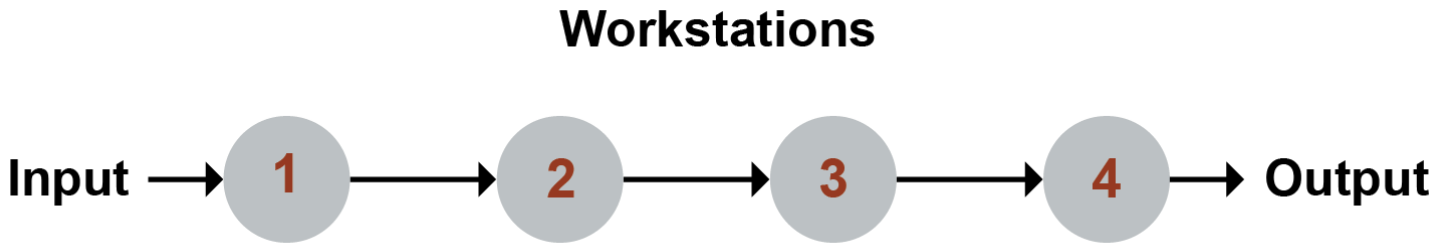


Cellular Layout (continued)

Benefits	Limitations
▪ Minimizes material-handling distances/factory floor space needs. ▪ Faster processing time. ▪ No work-in-process inventory accumulates. ▪ Lead times shrink. ▪ Reduced finished goods inventory.	▪ Works only if products can be grouped into product families. ▪ Locating work centers or cells near each other.

Product-Based Layout

Benefits	Limitations
▪ Lower total material-handling costs. ▪ Less work in process. ▪ Less floor area occupied by material in transit and storage. ▪ Simplicity of production control. ▪ Total production time is minimized. ▪ High degree of equipment and labor utilization.	▪ Limited flexibility. ▪ Manufacturing costs increase with a decrease in volume ▪ Single machine breakdown could shut down whole production line. ▪ Cannot easily respond to system changes.



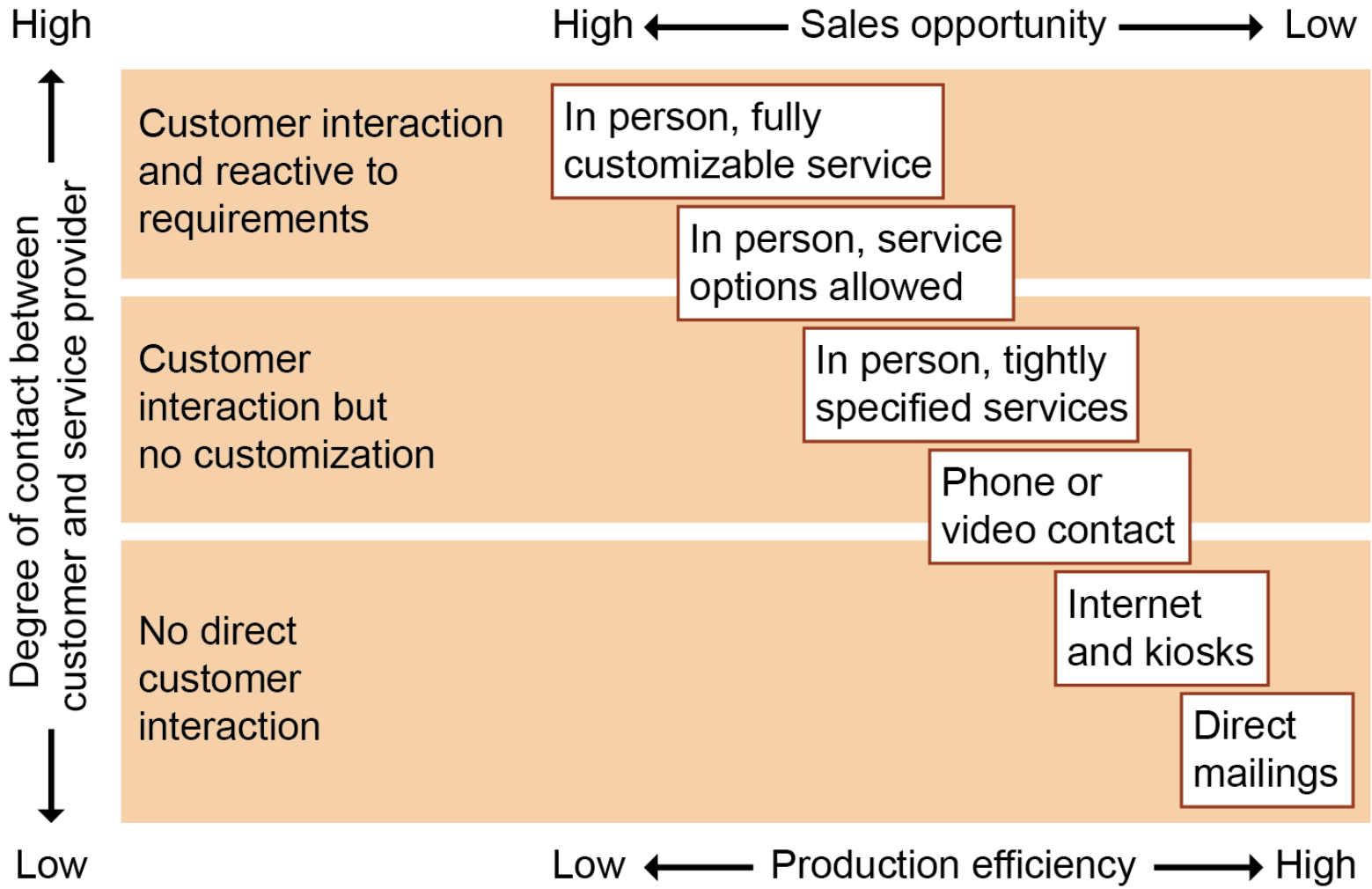
Product-Based Layout Versus Functional Layout Activity

	Product	Functional
Capital cost	↑	↓
Flexibility	↓	↑
Annual setup cost	↓	↑
Run cost	↓	↑
WIP inventory	↓	↑
Production and inventory control costs	↓	↑
Lead time	↓	↑

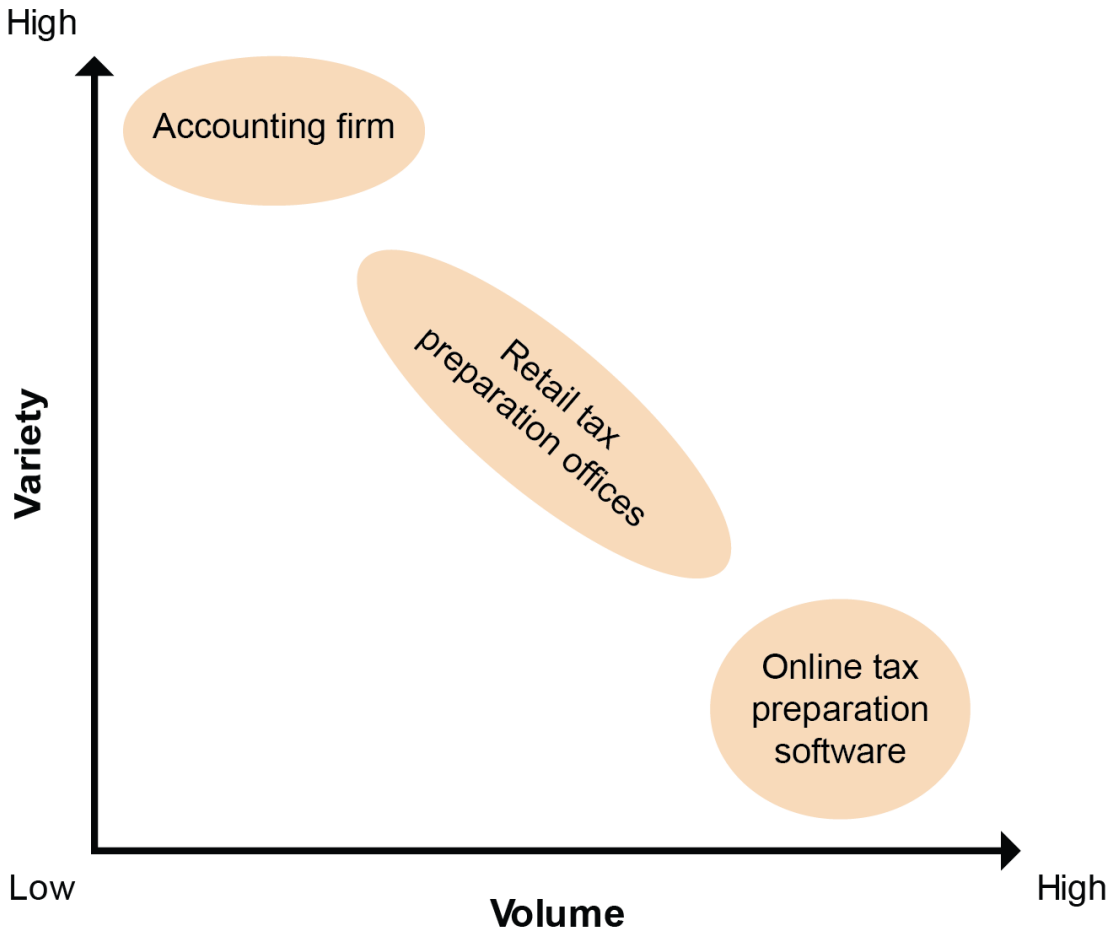
Process and Layout Tradeoffs

	Speed	Dependability	Flexibility	Quality	Cost
Project		Very high	Very high		
Work center		Very high	Very high		
Batch		Very high	Very high		
Line	Very high				Very high
Continuous	Very high				Very high

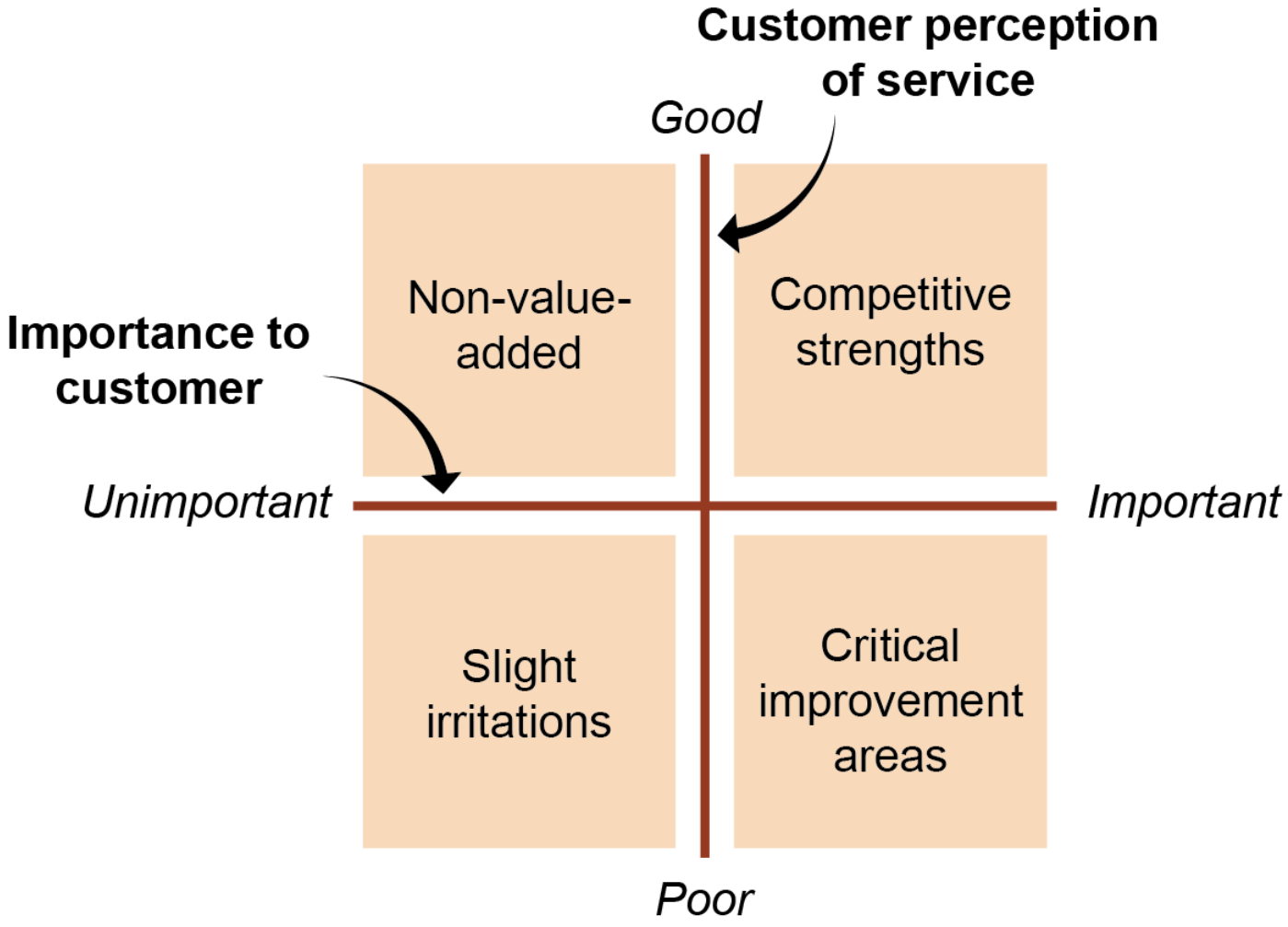
Service Design Matrix



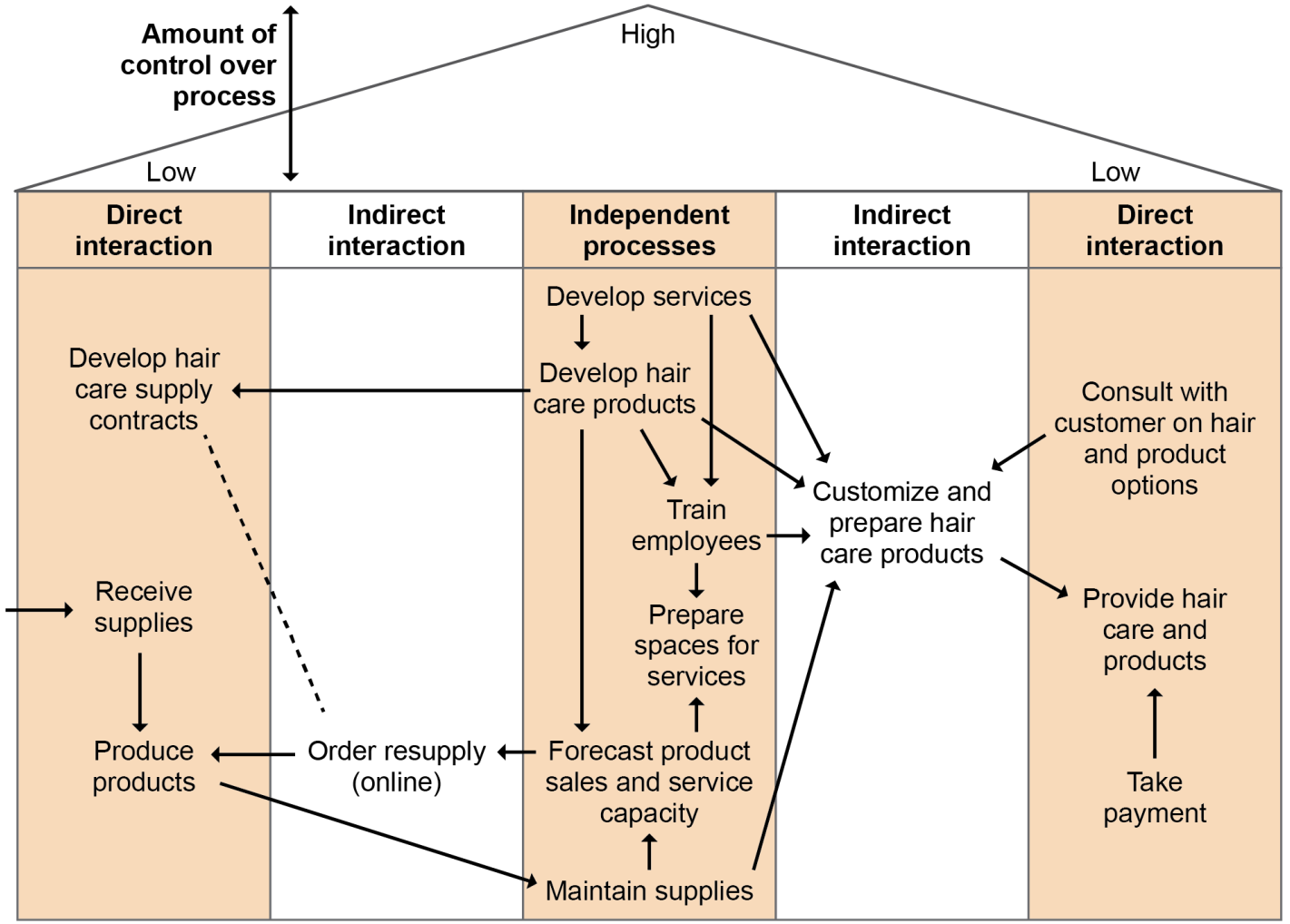
Product-Process Matrix and Service Environments



Service Gap Analysis Matrix

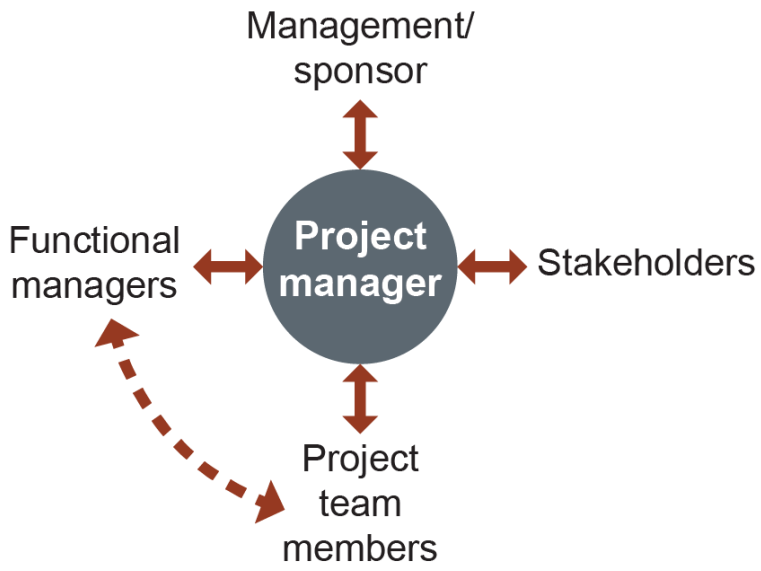


PCN Diagrams



Project Management

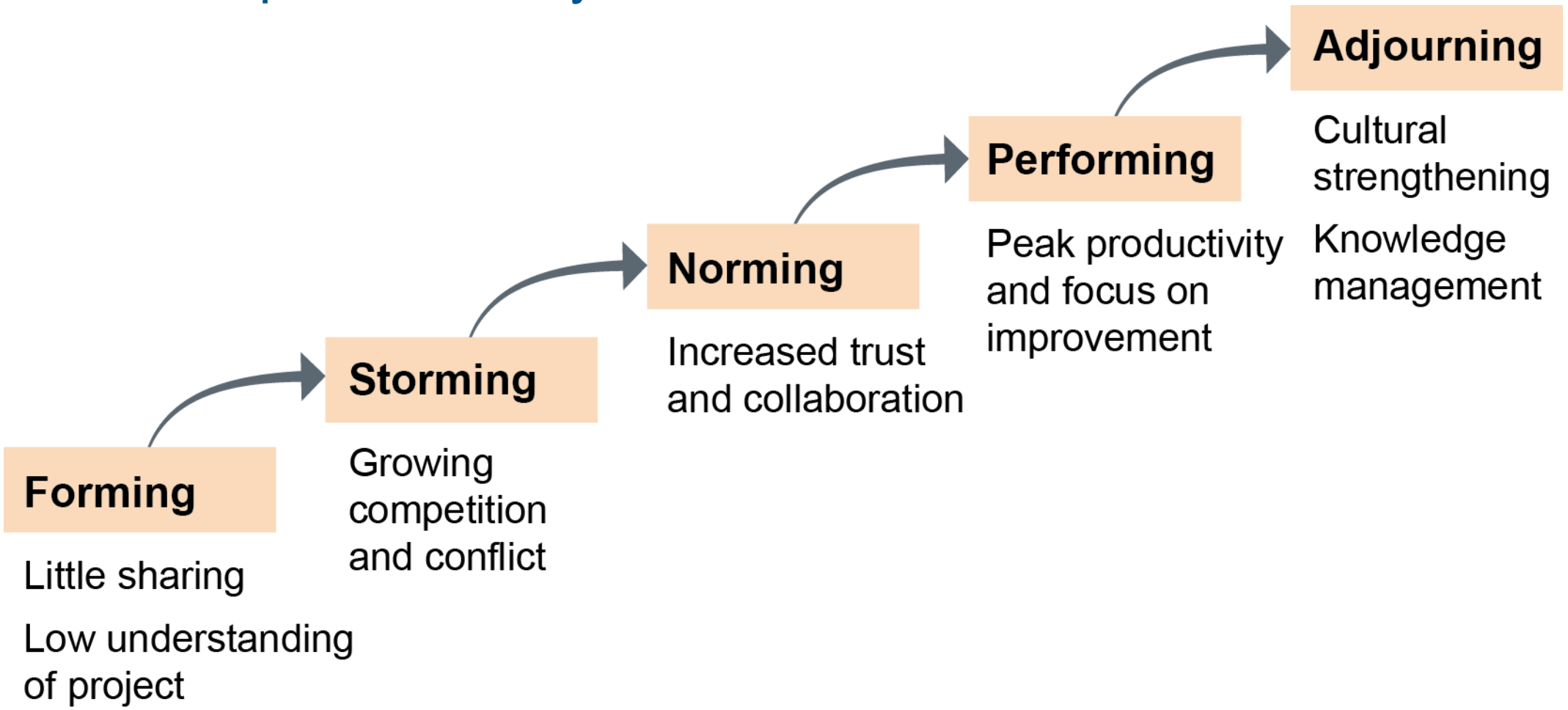
- Project charter and management support
- Project manager/leader
- Clear roles and responsibilities



Engine test	PM	Eng	Perf analytics	VP, Eng	VP, Acct
Run	I	R	I	A	I
Analyze results	I	C	R	A	I
Report	R	C	C	I	A
Follow up	R	C	I	I	A

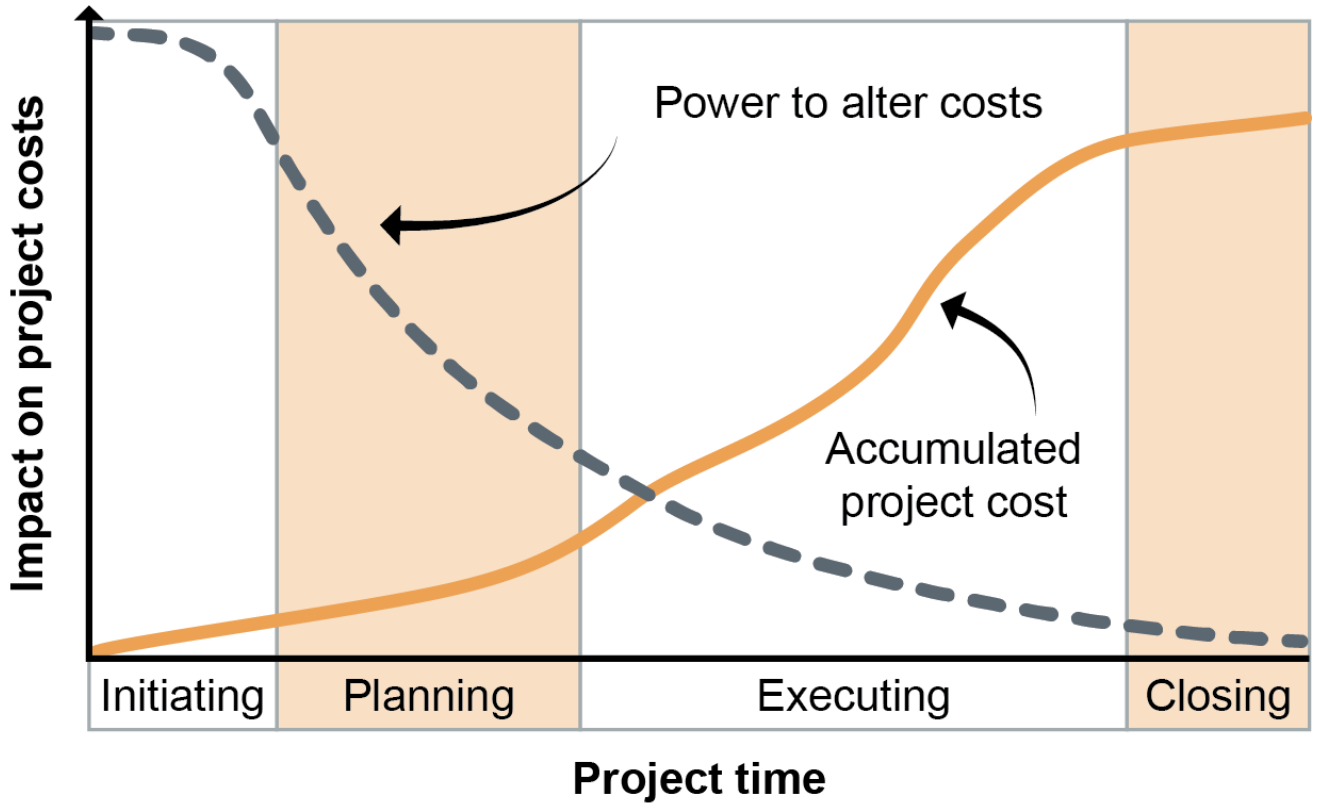
R = Responsible for task completion
C = Consulted (provides input on the work)
A = Accountable for outcome
I = Informed of progress

Team Development Theory



Traditional Project Concerns

- The project plan documents how different aspects of the project will be executed and controlled.
- Scope baseline
  - Scope statement
  - Work breakdown structure
- Project schedule
- Project budget



Agile Project Management: Scrum Example

Agile project management method for projects with high variability in requirements

- Tasks and issues can be prioritized and reprioritized to resolve bottlenecks.
- Tasks are done in sprints or iterations.
- Teams meet daily.
- Members are empowered.
- A scrum master removes obstacles.
- A product owner represents the customer.

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION F:
PERFORMANCE MONITORING AND KPIS

APICS

ASCM

Section F Learning Objectives

- Performance measurement and KPI principles
- Balanced scorecard
- Financial ratios: liquidity, activity, leverage, profitability, market value
- Financial ratio analysis and metrics
- Strategic and operational metrics

Metrics to Measure Performance

- Critical few KPIs at each level
- Motivate teams and individuals
- Metrics need
  - Performance criterion (metric)
  - Performance standard (target)
  - Actual measurement

KPIs

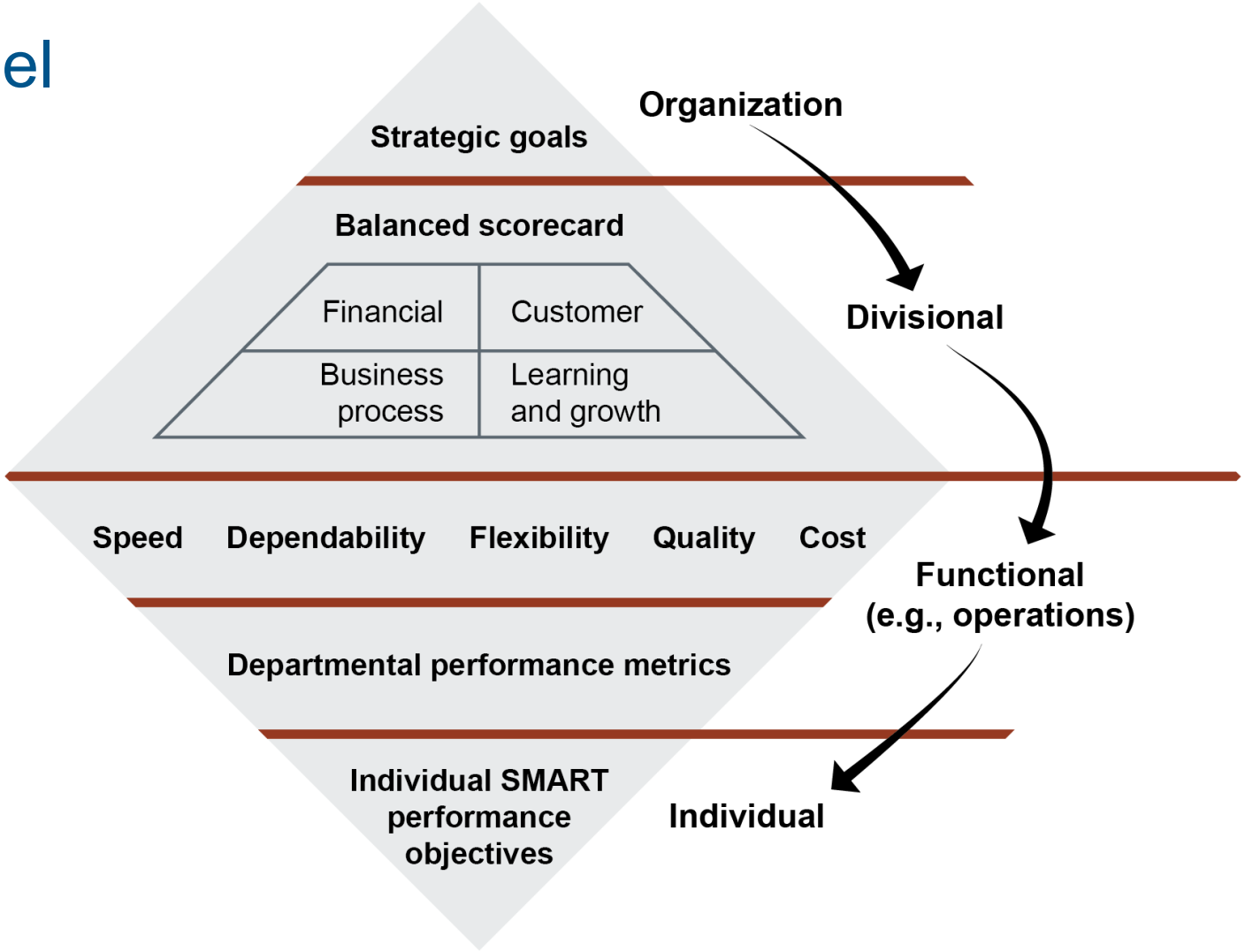
- Provide linkage to strategy
- Should reflect strategic priorities
- Should be set at strategic, tactical, and operational levels
- Can involve entire supply chain
- Don’t try to measure everything but to measure the right things

Key performance indicator (KPI):

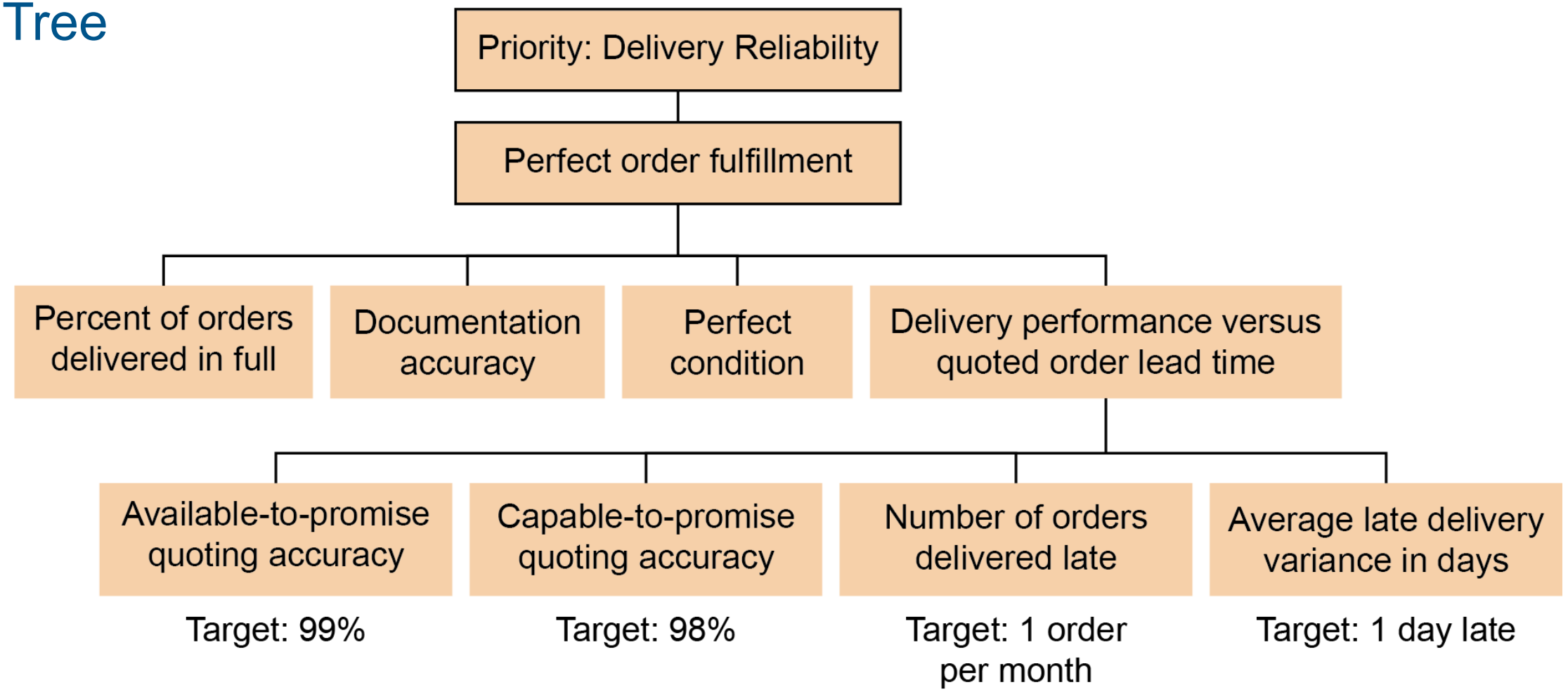
- Financial or nonfinancial measure
- Defines progress toward specific organizational goals

Integrated Measurement Model

Align operations performance with organization's goals and strategies



KPI Tree



Performance Targets and SCOR

Priorities	Metric
Dependability and speed	▪ On-time delivery ▪ Order fulfillment lead time ▪ Fill rate ▪ Perfect order fulfillment
Flexibility	▪ Supply chain response time ▪ Upside production flexibility ▪ Cash-to-cash cycle time ▪ Upside supply chain flexibility
Cost and speed (assets and utilization)	▪ Total inventory days of supply ▪ Net asset turns ▪ Supply chain management cost
Quality	▪ Warranty cost as a percent of revenue ▪ Value added per employee

Strategic-Level Metrics: Balanced Scorecard

Customer Perspective			
Goal	**Metric**	**Target**	**Actual**
Delivery	Orders in full	99%	98%

Business Process Perspective			
Goal	**Metric**	**Target**	**Actual**
No rework	Rework	0 units	2 units

Financial Perspective			
Goal	**Metric**	**Target**	**Actual**
Low finished goods	Carrying cost	<$50,000	$62,000

Innovation and Learning Perspective			
Goal	**Metric**	**Target**	**Actual**
Flexible	Cross-train	50%	28%

Ratio Analysis

Relation of one value to another that enables common-size comparison.

Significance is specific to industry and strategy.

Liquidity

- Satisfy short-term debt
- Positive cash flow

Activity

- Efficiency of asset use

Leverage

- Satisfy long-term debt

Profitability

- Signals health and management

Market value

- Stock attractiveness

Cash-to-Cash Cycle Time

Cash-to-Cash Cycle Time = Days' Inventory Outstanding + Days' Sales Outstanding – Days' Payables Outstanding

$$\text{Days' Inventory Outstanding} = \frac{\text{Average Inventory}}{\text{Cost of Goods Sold}} \times 365$$

$$\text{Days' Sales Outstanding} = \frac{\text{Average Accounts Receivable}}{\text{Net Credit Sales}} \times 365$$

$$\text{Days' Payables Outstanding} = \frac{\text{Average Accounts Payable}}{\text{Cost of Sales}} \times 365$$

Operational Performance Measurements

Global operational metrics

- Total factor productivity

Detailed performance measures

- Generic performance objectives: Speed, dependability, flexibility, quality, and cost

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION G:
RISK MANAGEMENT

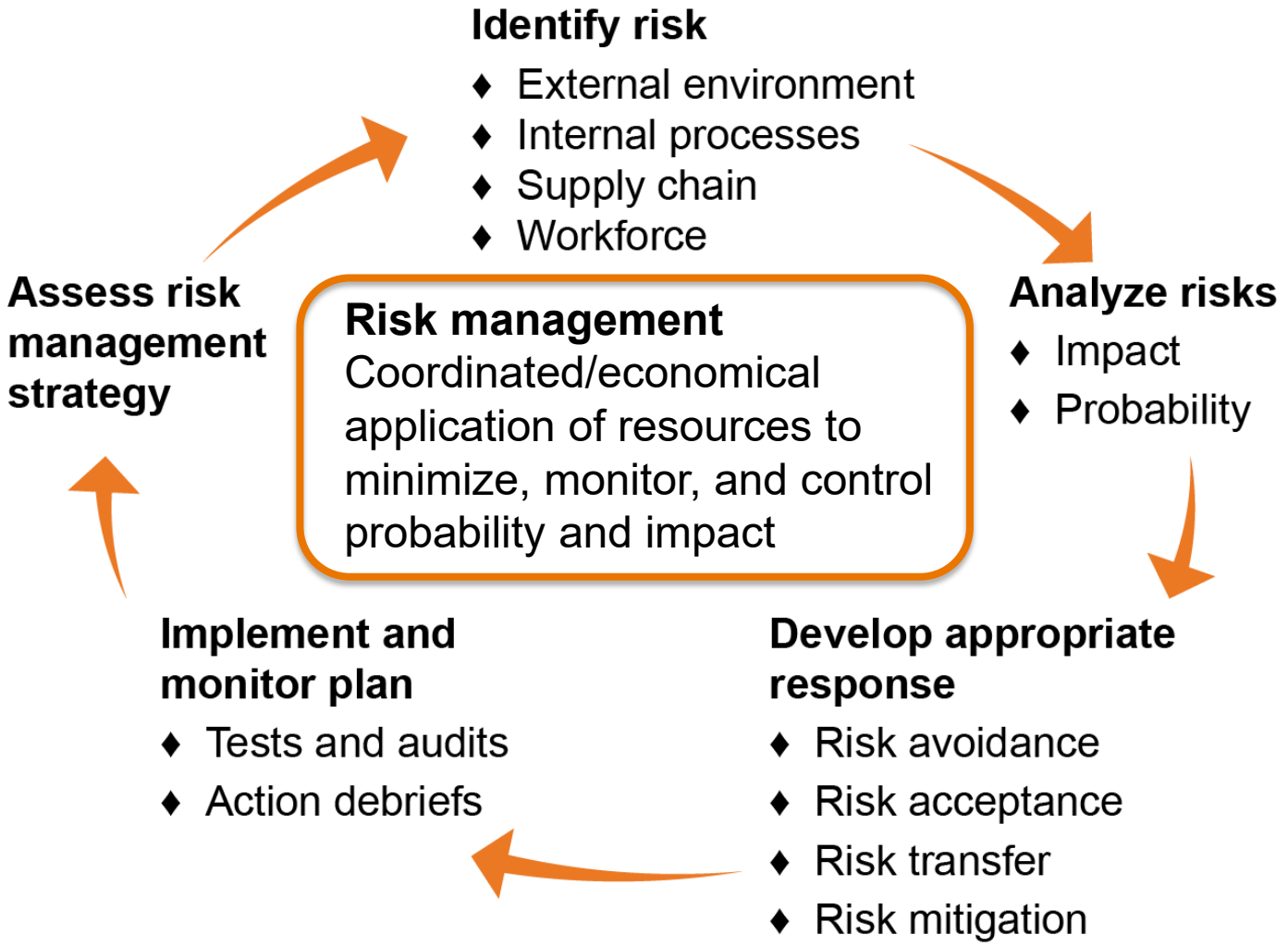
APICS

ASCM

Section G Learning Objectives

- Risk management process and strategies
- Failure mode and effects analysis (FMEA)
- Supply chain risk

Risk Management Process



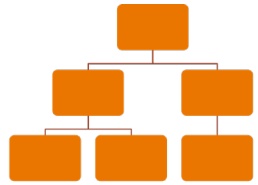
Failure Mode and Effects Analysis (FMEA)

Failure	Probability of Occurrence	Severity of Failure	Probability of Escape from Detection	RPN
Goods not secured	5	6	2	60
Goods incorrectly secured	8	4	5	160
Goods incorrectly loaded	7	4	7	196

FMEA = Evaluate a design process to identify and rank potential failures.

Types of Risks

- External
  - Currency rates, theft, civil unrest
- Environmental
  - Natural disasters, fire and flood, environmental requirements
- Technical
  - Equipment or IT failure, power outage
- Organizational
  - Inadequate resources, unethical acts, poor supplier performance



Supply Chain and Legal/Regulatory Risks

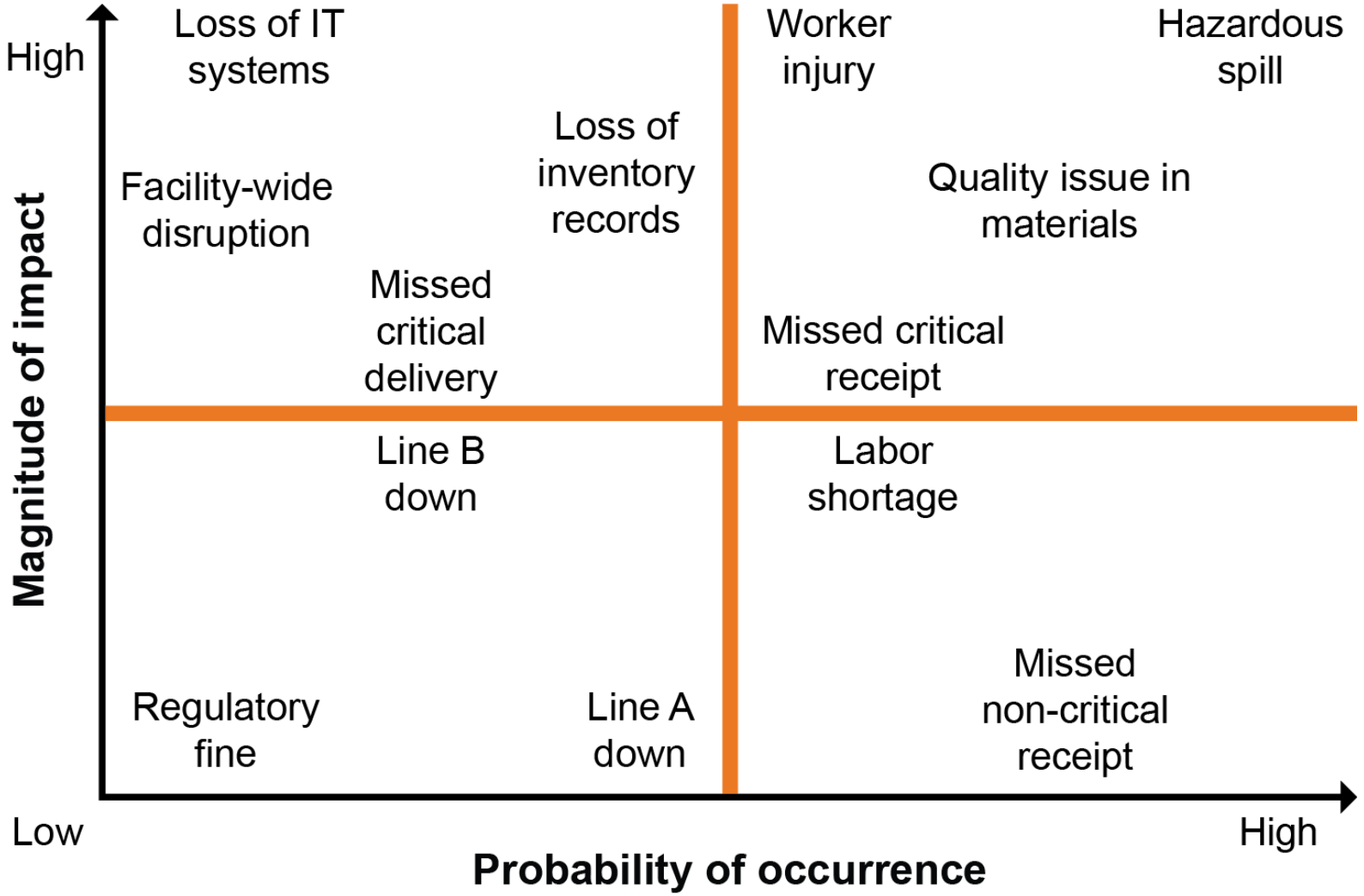
Supply chain risks

- Natural events
- Technical problems
- Forecast inaccuracy
- Price increases
- Loss of intellectual property
- Loss of real property or value
- Loss of reputation

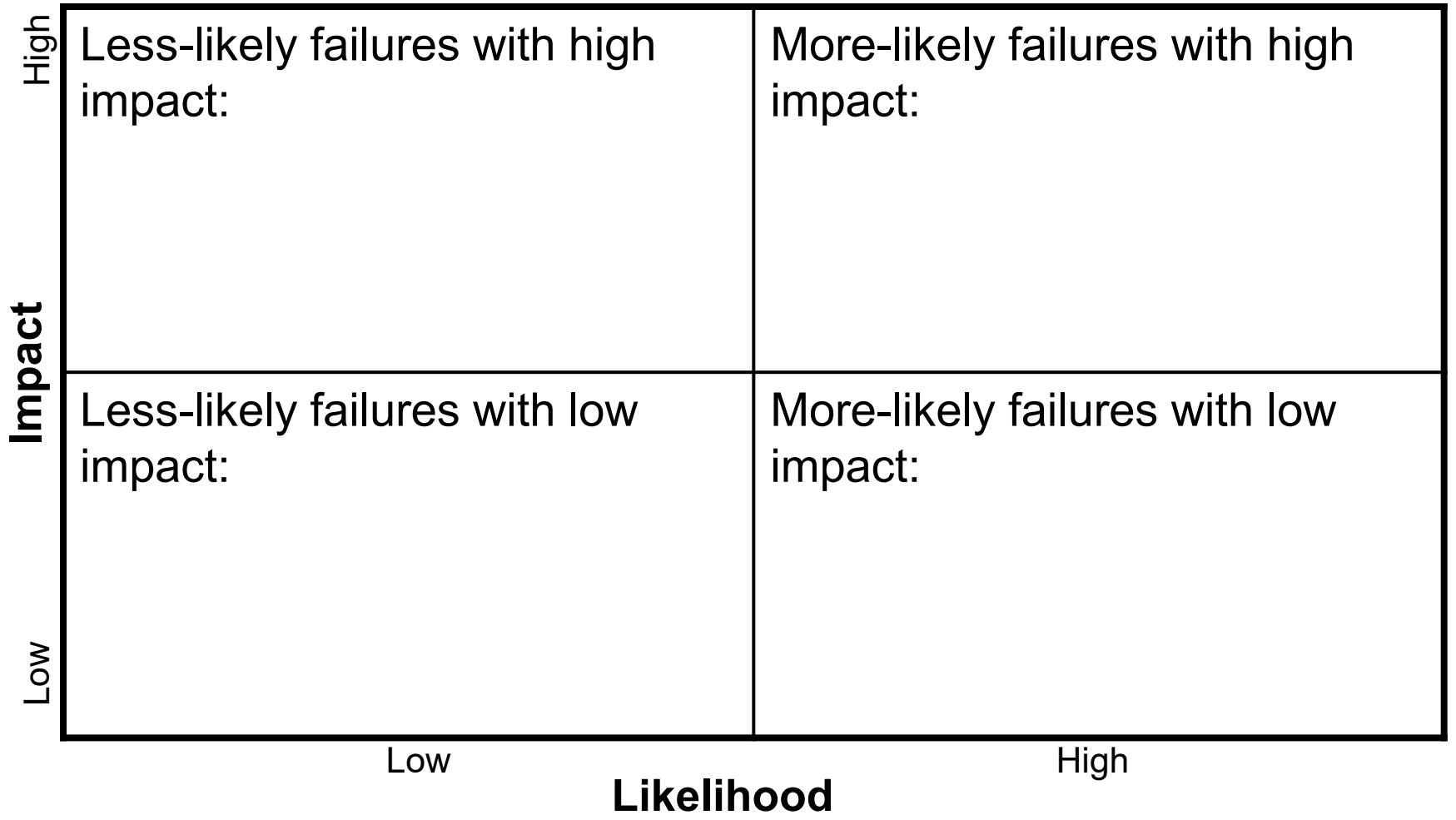
Legal and regulatory compliance risks

- Compliance risk
- Contract risk
- Trademark/patent infringement
- Bribery and corruption

Risk Matrix



Risk Matrix Discussion



Responses to Risk

Response depends on

- Risk's magnitude (probability and impact)
- Probability of risk management strategy success and its cost
- Secondary risks created by the response
- Organization's risk tolerance.

Risk acceptance	Risk avoidance	Risk mitigation	Risk transfer
▪ Decision to take no action ▪ Inability to plan response	▪ Changing plan to eliminate risk or protect objectives from its impact	▪ Reducing probability and/or impact	▪ Transferring all/part of risk to third party (e.g., insurer, supplier)

Recovery Strategies

- Planning first response (e.g., protocols such as product recalls or managing spills/emissions)
- Training and equipping employees (e.g., protective gear)
- Identification of alternative resources (e.g., workplaces, temporary workers)
- Debriefing, analysis, and prevention

Contingency planning

- Specifying alternative plans to facilitate success if certain risk events occur

CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION H:
CAPITAL EQUIPMENT AND FACILITIES

APICS

ASCM

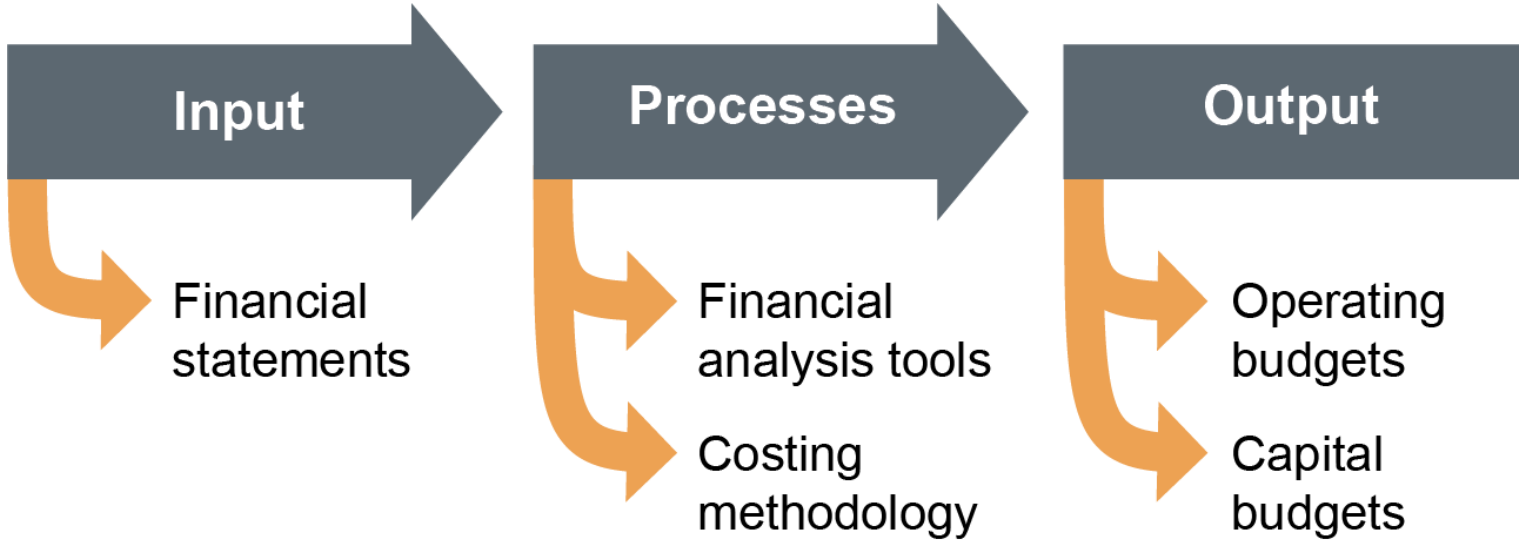
Section H Learning Objectives

- Business planning
- Capital budgeting, payback period, net present value, internal rate of return, and profitability index
- Total productive maintenance
- Health, safety, and environment compliance
- Environmental footprint tradeoffs

Business Planning

Statement of long-term strategy and revenue, cost, and profit objectives

Accompanied by budgets, a projected balance sheet, and a cash flow statement. Grouped by product family and translated into synchronized functional plans.

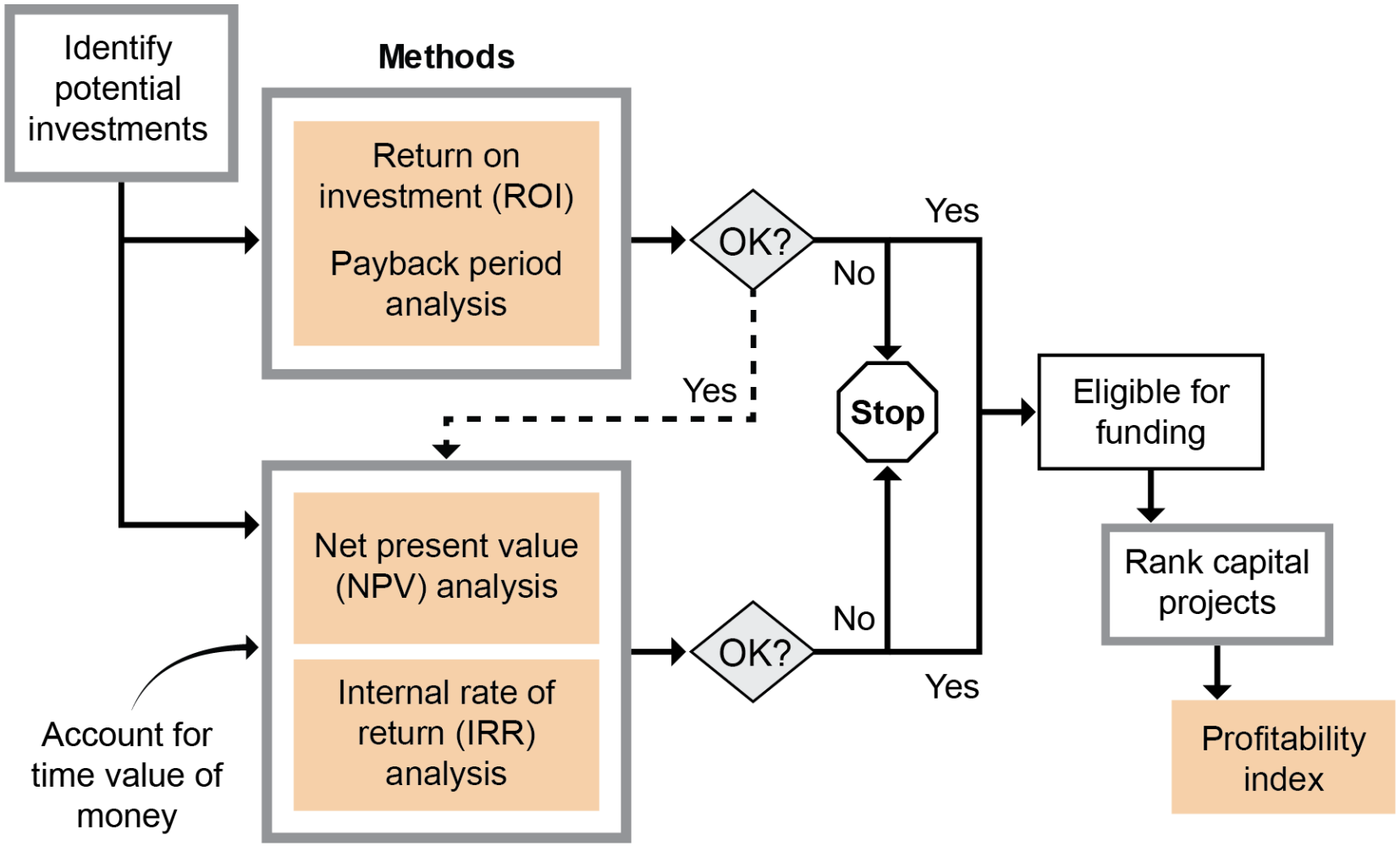


Capital Budgeting

Planning and financing of outlays for new equipment, new product lines, and plant modernization

- Opportunity cost
  - Return on capital that could have resulted if capital had been invested in another way
- Sunk cost
  - A cost already paid and not relevant to future decisions

Capital Budgeting Tools



Net Present Value

Initial investment	$20,000
Estimated life	20 years
Annual cash inflows	$5,000
Cost of capital (minimum return)	12%
Present value ($5,000 x 7.47)	$37,350
Initial investment	($20,000)
Net present value	$17,350

Anticipated net cash flows over project lifetime are the investment's future value (FV).
Initial outflow is in period 0.
Future is periods 1 to end.
Future periods are reduced to present value (PV).
Initial investment less PV is NPV.

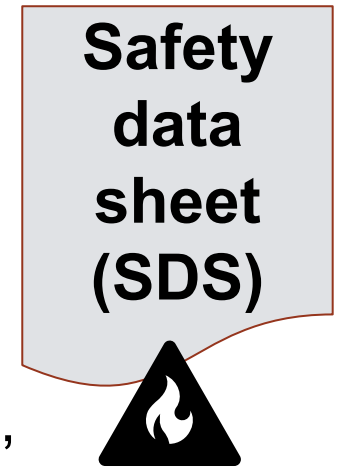
Reducing Facility Impact on HSE

Total productive maintenance (TPM)

- Preventive maintenance: scheduled downtime
- Flexibility, less material handling, and continuous flows
- Benefits
  - Equipment life/investment protection
  - Worker safety
  - Resilience

Health, safety, environment (HSE)

- Regulatory compliance
- Efficient use of energy, water, and other resources
- Protecting employee health and improving employee productivity
  - PPE
  - Lockout/tagout
- Reducing noise, waste, pollution, and harm to the environment



CPIM

CERTIFIED IN PLANNING
AND INVENTORY MANAGEMENT

SECTION I:
SUSTAINABILITY STRATEGIES

APICS

ASCM

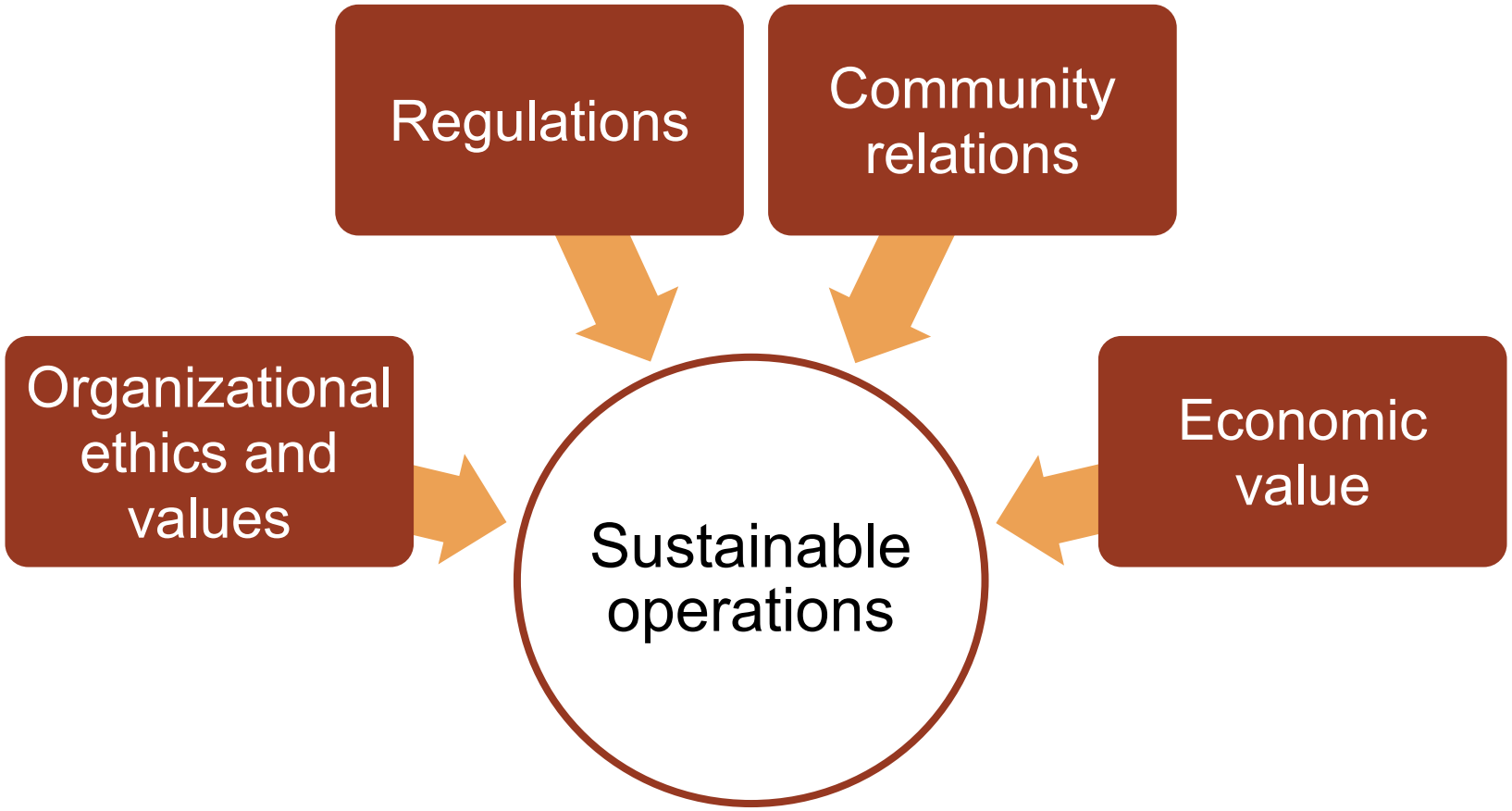
Section I Learning Objectives

- Definition of sustainability and social responsibility
- Forces driving interest in sustainability
- Perspectives represented by triple bottom line and tensions these perspectives cause
- Sources of guidance in developing a sustainability strategy
- Sustainability strategy objectives
- Role of measurement and auditing in sustainability
- Global Reporting Initiative (GRI)

Sustainability and Social Responsibility

- Sustainability: “Activities that provide present benefit without compromising the needs of future generations.”
- Social responsibility: “Commitment…to behave ethically and to contribute to community development…improving the workforce’s quality of life.”
- Ethical obligations.
- Short- and long-term effects of a firm’s actions.
- Holistic sense of effects on the environment, the firm, and society.

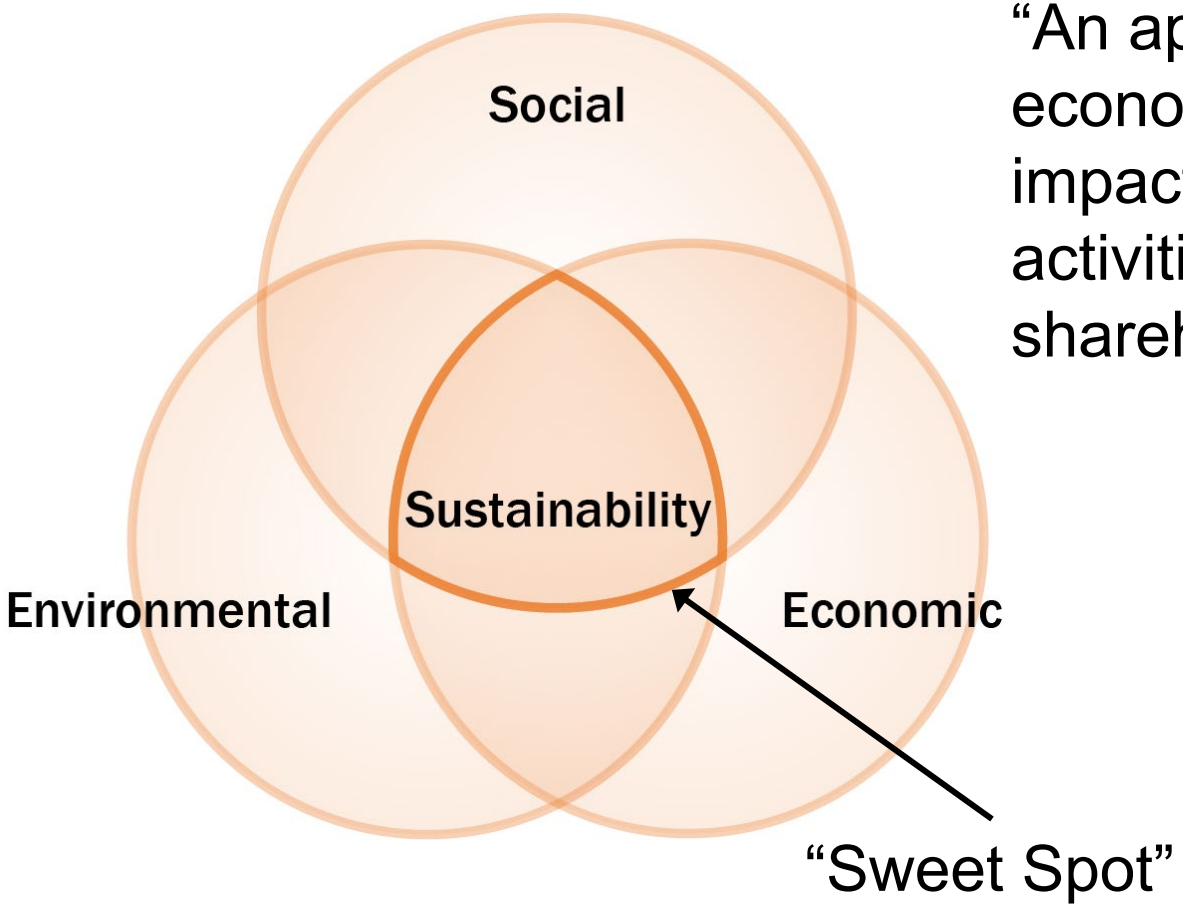
Forces Driving Sustainability Strategies



Areas of Focus in Sustainability

- Ethics
- Governance
- Transparency
- Business relationships
- Financial return
- Community involvement/economic development
- Value of products and services
- Employment practices
- Protection of environment

Triple Bottom Line



"An approach that measures the economic, social, and environmental impact of an organization's activities...creating value for both its shareholders and society."

Choosing a Strategic Focus

- Align sustainability strategy with issues significant to the organization.
  - Issues important to society but not directly influenced by the firm
  - Value chain issues directly affected by the firm
  - Issues that affect the way the firm acts or competes

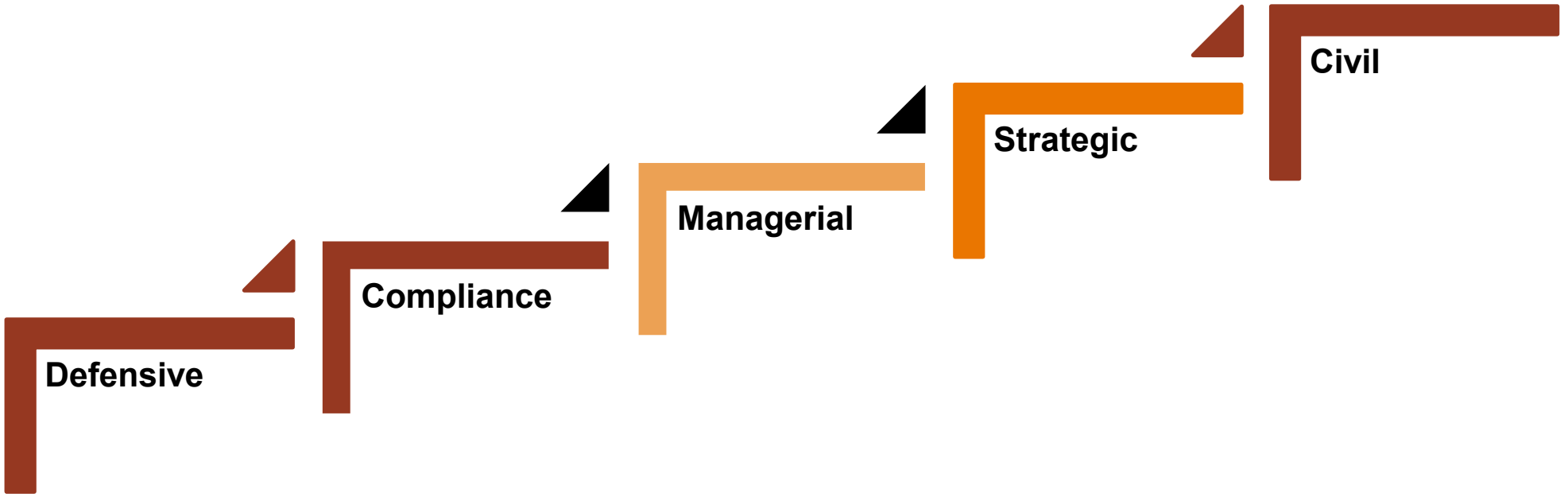
Choosing a Strategic Focus Exercise

Value Chain Activity	Impact on Society
Human resource management	▪ Health-care benefits ▪ Safe working conditions ▪ Compensation policies ▪ Education and training
Procurement	▪ Supply chain practices (child labor, conflict diamonds, and so on) ▪ Use of natural resources
Marketing and sales	▪ Truthful advertising ▪ Policies on advertising to children ▪ Privacy

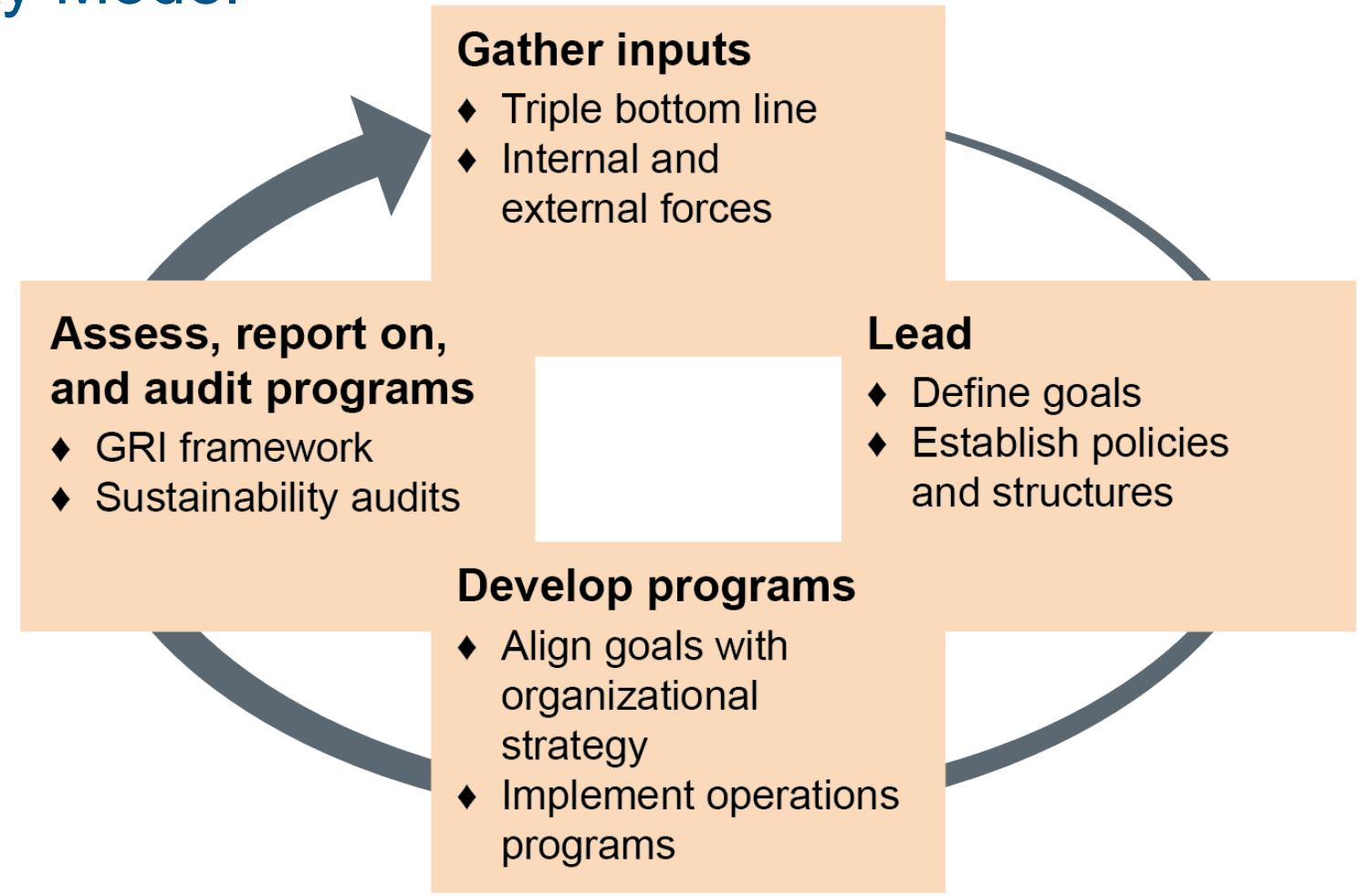
Benefits of Taking a Strategic Approach

- High-level strategic approach enlists top management support.
- Sustainability strategies can be integrated and coordinated across all parts of the organization.
- The organization takes a more proactive and long-term perspective.

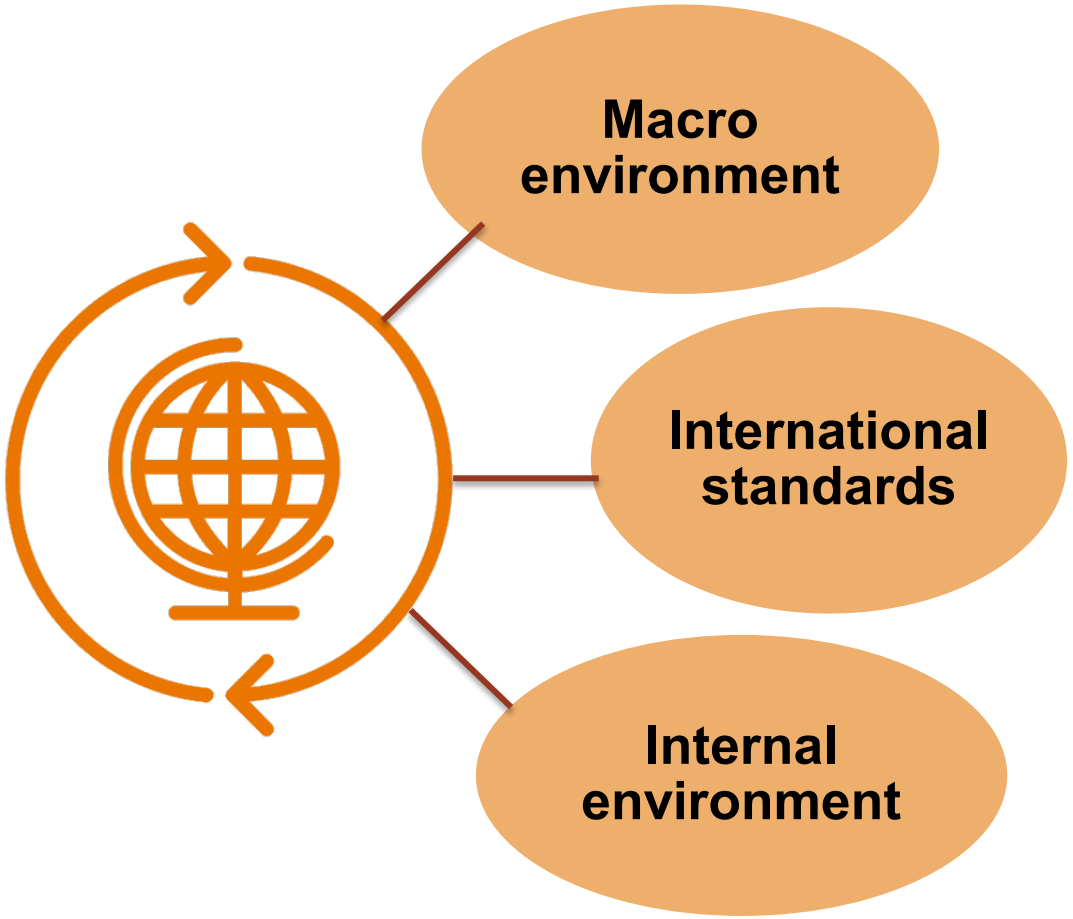
Organizational Maturity in Sustainability Strategies



Sustainability Model



Inputs to Sustainability Strategy



- PESTEL analysis

- ASCM Enterprise Certification
- ISO 14000/26000
- SA 8000
- UN Global Compact

- Culture and strategy
- Value chain
- Resources/expertise

Role of Leadership in Sustainability

- Provide overarching vision.
- Set and endorse strategy and goals.
- Communicate and engage stakeholders.
- Align culture and resources with goals.
- Support accountability for investments.

United Nations Global Compact Principles

Category	Principle	
Human Rights	1	Support and protect internationally proclaimed human rights.
	2	Ensure non-complicity in human rights abuses.
Labour	3	Uphold freedom of association, right to collective bargaining.
	4	Eliminate forced and compulsory labour.
	5	Abolish child labour.
	6	Eliminate discrimination in employment and occupation.
Environment	7	Support precautionary approach to environmental challenges.
	8	Promote greater environmental responsibility.
	9	Encourage development and diffusion of environmentally friendly technologies.
Anti-Corruption	10	Work against corruption in all of its forms, including extortion and bribery.

Identifying and Managing Risks to Sustainability

Supply chain

Environmental and ethical practices

Processes

Effect on health and well-being of communities and employees

Environmental effects of byproducts and emissions

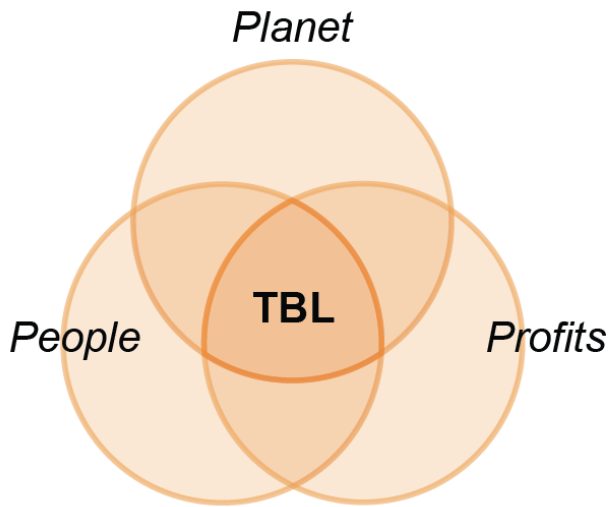
Products

Product designs (waste, depletion of resources)

Effect on customer well-being

Facilities

Impact on local resources, plants and animal communities



Measuring Sustainability Performance

Accountability and Continuous Improvement	
Sustainability audits ▪ Internal and external	Global Reporting Initiative (GRI) ▪ GRI Standards