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CERTIFIED IN LOGISTICS,
TRANSPORTATION AND DISTRIBUTION

MODULE 2:
DEMAND MANAGEMENT AND SUPPLY (CAPACITY MANAGEMENT)

APICS

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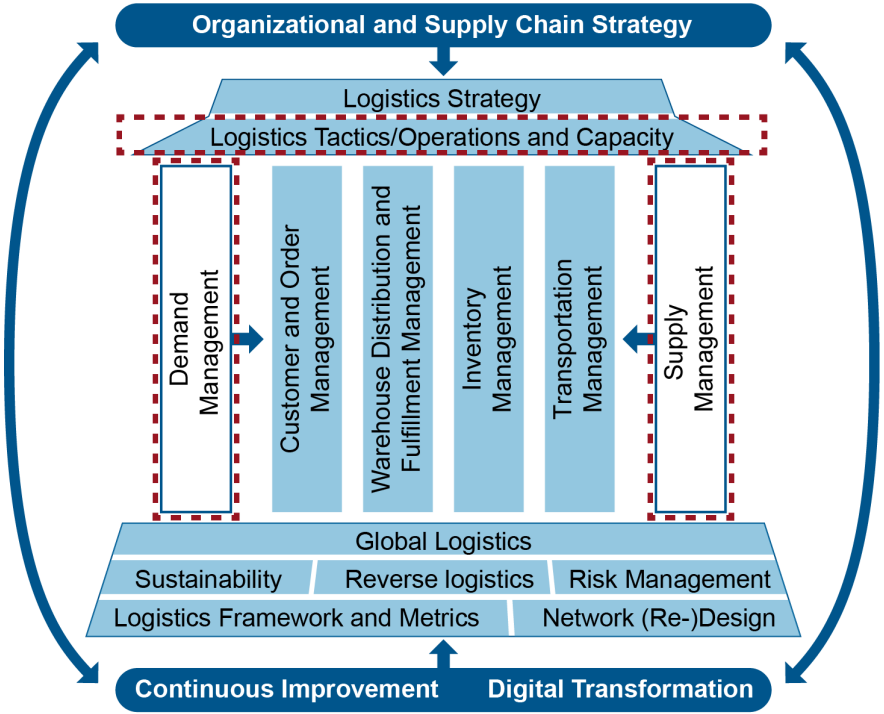
Module 2 Overview



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MODULE 2, SECTION A: FORECAST DEMAND

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Develop a Forecasting Process and Methods

Forecasting

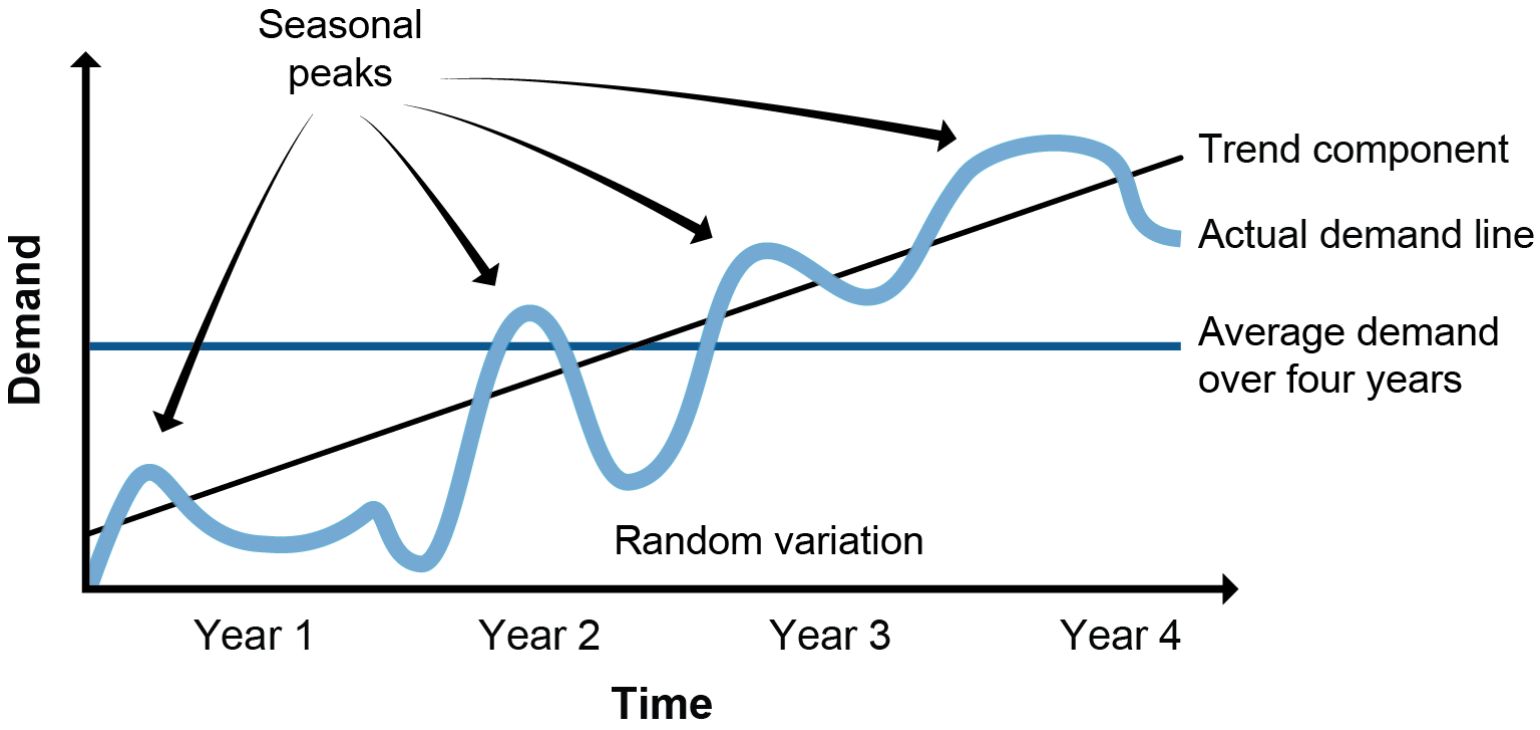
- Forecasts
  - When lead time is insufficient
  - Qualitative, quantitative, or a mix of both
- Logistics needs to interpret and assess reliability
- Shorter terms more reliable
  - Long-term (3+ years)
  - Medium-term (1 to 2 years)
  - Short-term (less than 1 year)

Develop a Forecasting Process and Methods

The Nature of Forecasting

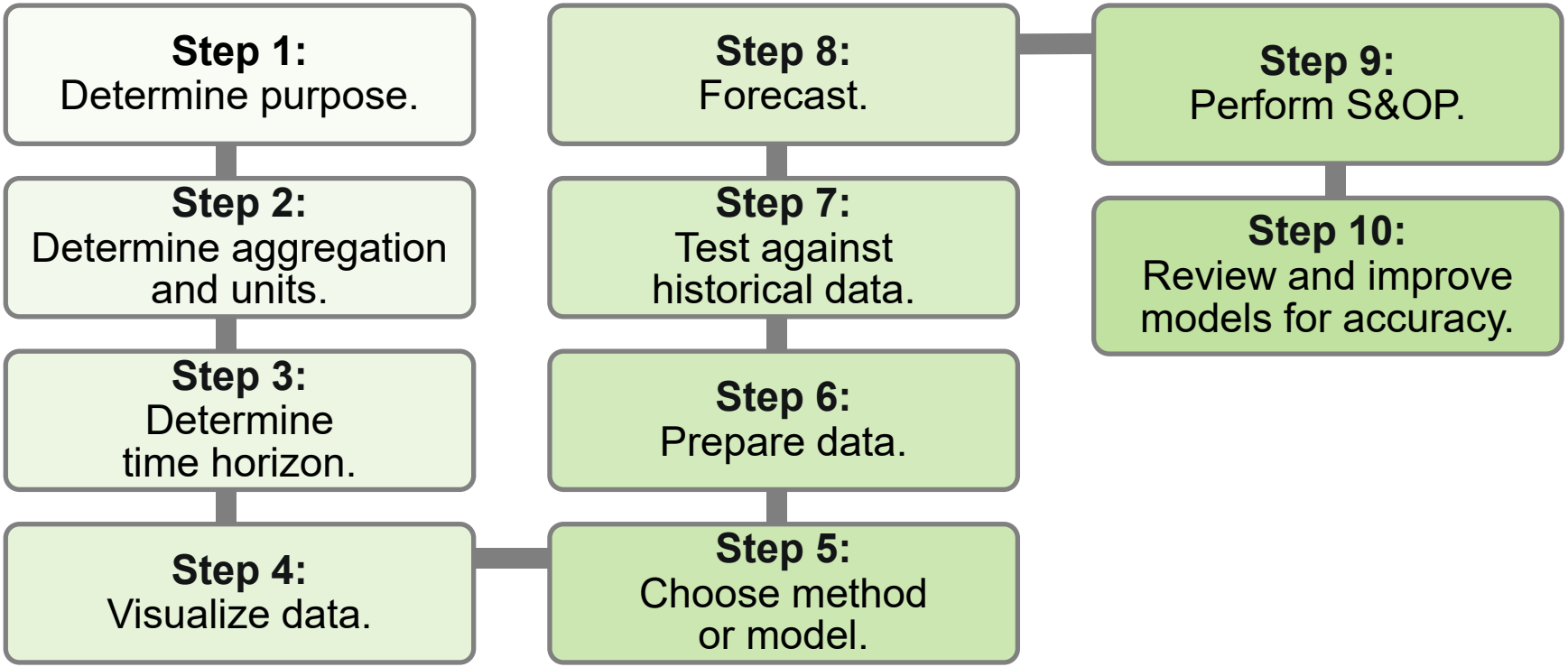
- Future is uncertain.
- “Forecasts are always wrong.”
- Bias.
- Cost-benefit.
- Aggregate more reliable.
- Check data sources and simplify models.
- Use demand history.
- Consumer demand.

Factors Affecting Demand



Develop a Forecasting Process and Methods

Forecasting Process



Develop a Forecasting Process and Methods

Forecasting Methods

Qualitative

- Beware of bias
- Judgmental/expert judgment
- Delphi method
  - Anonymous experts
  - Consensus
  - Avoids groupthink
- Consider using both qualitative and quantitative

Quantitative

Time series:

- Naive
- Simple moving average
- Weighted moving average
- Exponential smoothing

Associative (causal):

- Simple regression

Deseasonalizing

	A	B	C	D	E	I	J	K	L
1		Raw Data					Deseasonalized Data		
2	**Month**	**Year 1**	**Year 2**	**Year 3**	**Month Average**	**Seasonal Index**	**Year 1**	**Year 2**	**Year 3**
3	Jan	34	27	32	31.00	2.214	15.35	12.19	14.45
4	Feb	33	31	26	30.00	2.143	15.40	14.47	12.13
5	Mar	10	11	12	11.00	0.786	12.73	14.00	15.27
6	Apr	3	4	5	4.00	0.286	10.50	14.00	17.50
7	May	0	2	4	2.00	0.143	0.00	14.00	28.00
8	Jun	2	1	3	2.00	0.143	14.00	7.00	21.00
9	Jul	0	1	2	1.00	0.071	0.00	14.00	28.00
10	Aug	4	3	5	4.00	0.286	14.00	10.50	17.50
11	Sep	9	11	10	10.00	0.714	12.60	15.40	14.00
12	Oct	14	13	15	14.00	1.000	14.00	13.00	15.00
13	Nov	27	29	25	27.00	1.929	14.00	15.04	12.96
14	Dec	34	30	32	32.00	2.286	14.88	13.13	14.00
15	**SUM**	170	163	171	168				
16	**Year Average**	14.17	13.58	14.25	14.00				

Values used on following slides.

Deseasonalized values closer to year average

Simple and Weighted Moving Average

Smooths out random spikes or dips:

- 3−Month Moving Average = $\frac{(M1 + M2 + M3)}{3}$
- January Year 4 Forecast = $\frac{(15 + 12.96 + 14)}{3} = 13.99$ Units

If recent periods are better predictors:

- 3−Month Weighted Moving Average = $\frac{(1 \times M1) + (2 \times M2) + (3 \times M3)}{6}$
- January Year 4 Forecast = $\frac{(1 \times 15) + (2 \times 12.96) + (3 \times 14)}{6}$ $= 13.82$ Units

Sum of weights

Exponential Smoothing and Reseasonalizing

- Smoothing constant (alpha, α): 0–1 (percentage)
- New Forecast = (α × Last Period's Demand)
  + [(1 − α) × Last Period's Forecast]
- January Year 4 Forecast = (0.3 × 14) + [(1 − 0.3) × 16.2]
  = 15.54 Units

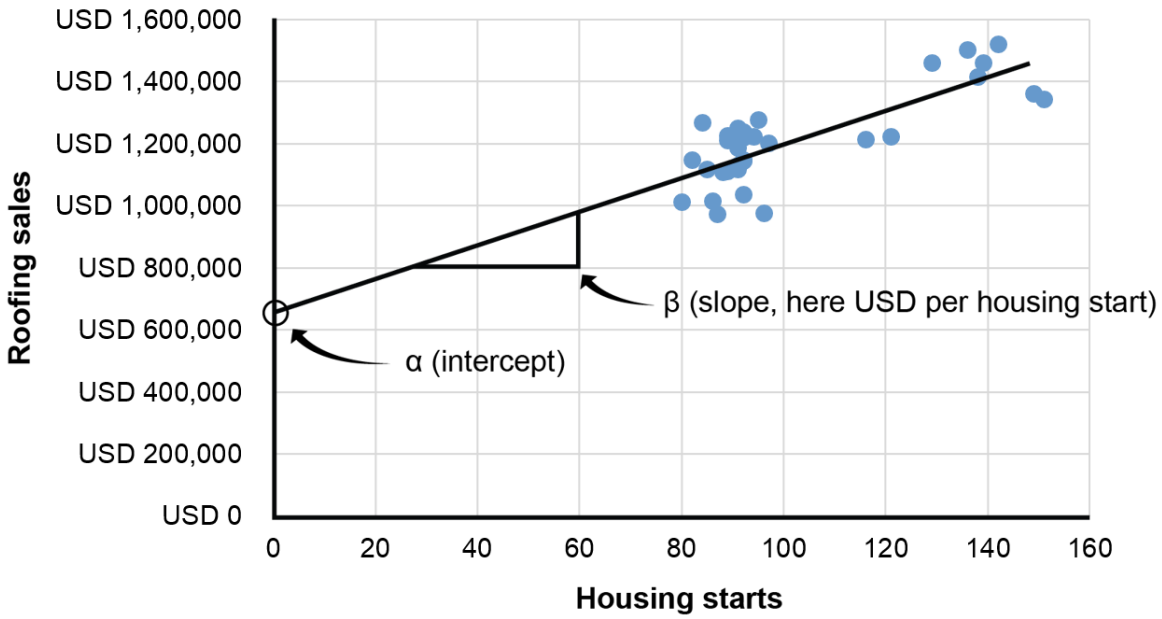
  30% weight 70% weight
- Reseasonalize
  - 15.54 units × 2.214 (January year 3 seasonal index)

    = 34.4 units, rounded up to 35 units as forecast for January year 4

Develop a Forecasting Process and Methods

Quantitative: Associative (Causal)

- Simple regression
  - Independent variable (predictor, x)
  - Dependent variable (predicted, y)
- $y = \alpha + \beta x$
  - Roofing Sales = α + ($\beta \times$ Prior Month's Housing Starts)



Coefficient of Correlation (*r*) and *r*-Squared

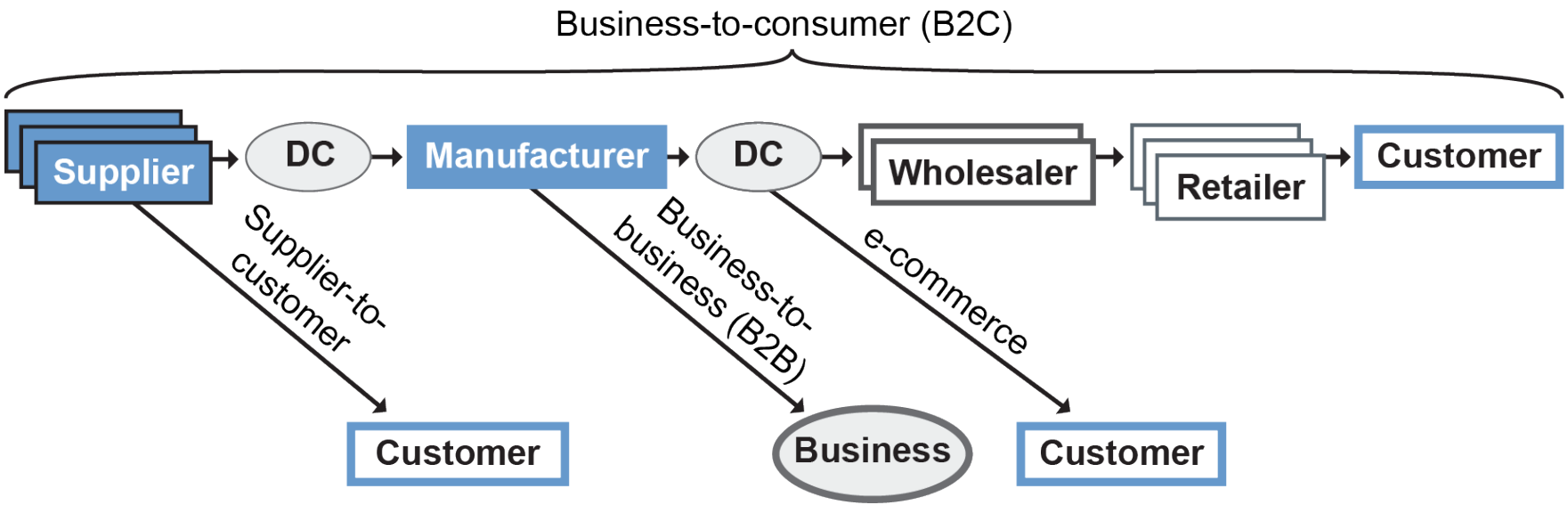
- Statistical measure of degree to which changes to the value of one variable predict change to value of another *(r)*
  - R-squared *(r^2)* shows fit: e.g., *r* of 0.79 squared = 0.6241, so housing starts explain 62.41% of change in roofing sales.
- *r* is range of values between –1.0 and +1.0

***r* = 1.0** is *perfect* positive correlation.

***r* = 0.0** is not correlated at all.

***r* = –1.0** is *perfect* negative correlation.

Forecasting for Distribution Channels



Interpret Forecasts

Accuracy (Error Rates)

- **Forecast error:** Forecast Error = $|\text{Actual} - \text{Forecast}|$
- **APE:** Forecast Error as a Percentage = $|\text{Actual} - \text{Forecast}| \div \text{Actual}$
- **MAD:** Average of absolute deviations
- **MSE:** Average of errors squared and then summed
- **MAPE:** Average of summed forecast error percentages

Interpret Forecasts

Accuracy (Error Rates)

- Tracking signal: Used to indicate the existence of any positive or negative bias in a forecast.
- Tracking Signal = $\frac{\text{Algebraic Sum of Forecast Errors}}{\text{MAD}}$
- Exceptions: Outliers could be errors or not.

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MODULE 2, SECTION B: UNDERSTAND DEMAND MANAGEMENT

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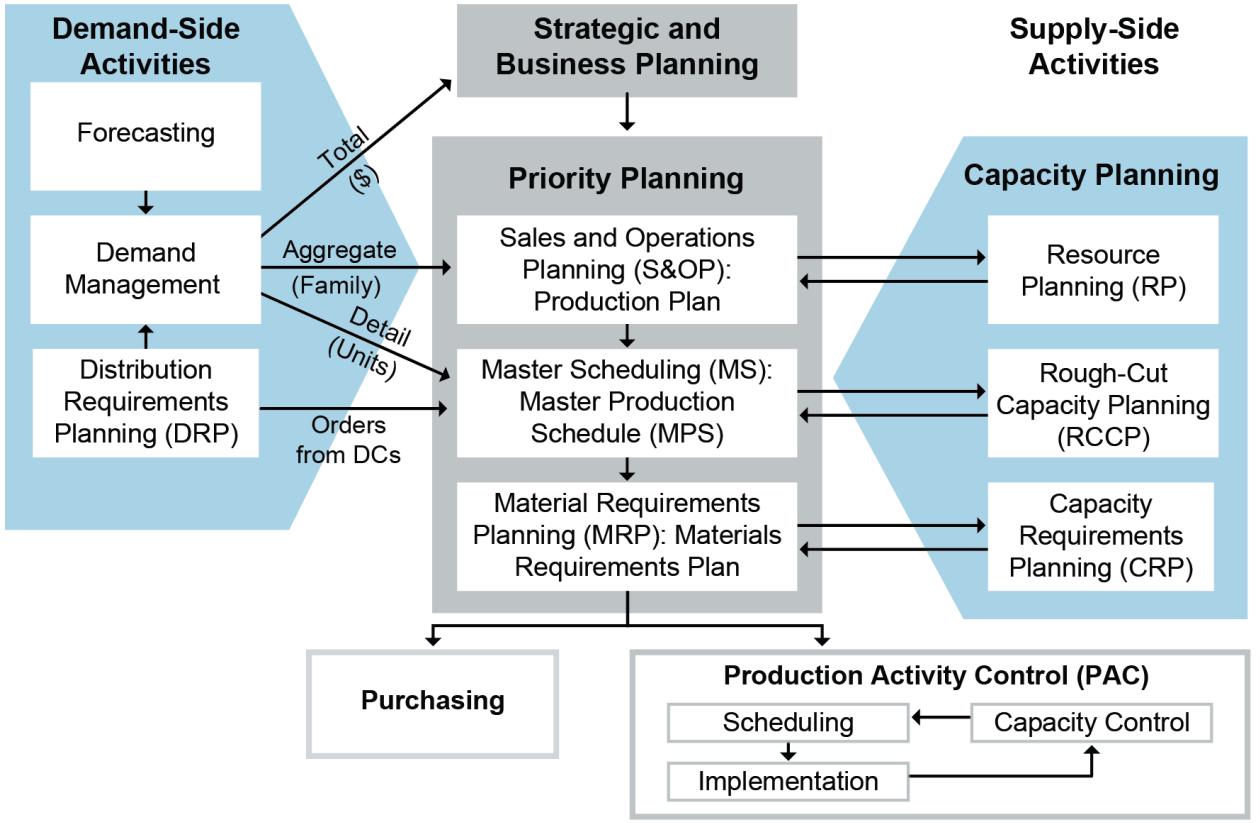
Components of Demand Management

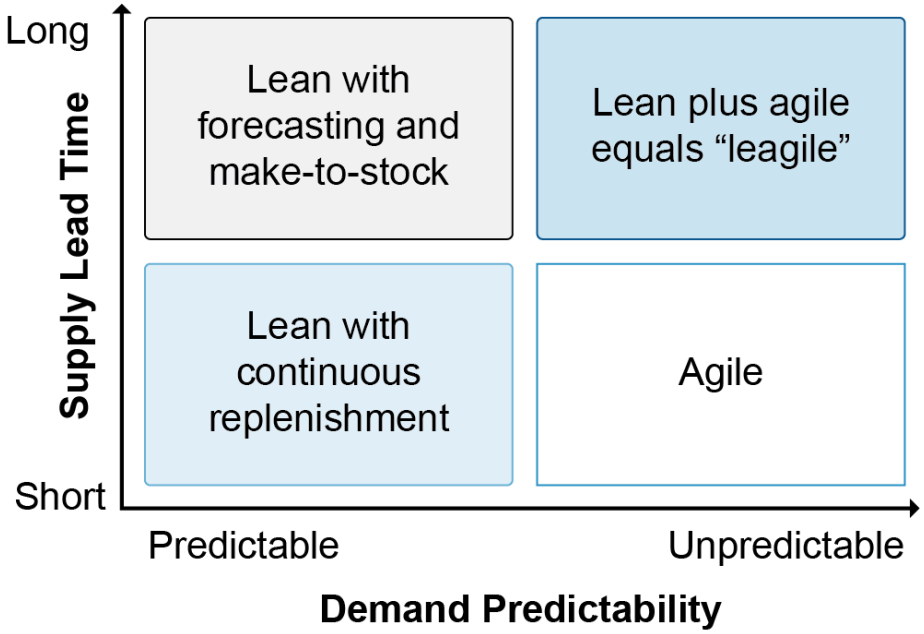
Understand Demand Management and Its Components

Manufacturing Planning and Control

Priority planning synchronizes demand and supply.



High-Level Manufacturing Strategies



- Postponement: Deliberate delay of final differentiation
  - Needed for lean + agile
- Manufacturing (form) postponement
  - Light manufacturing postponement at DCs
  - Geographic postponement

Supply Planning

- Production planning: chase, level, hybrid. Level calculation:
  - Production Rate = $\frac{(\text{Ending Inventory} - \text{Beginning Inventory}) + \text{Forecast}}{\text{Number of Periods}}$
  - = $\frac{(12{,}000 - 10{,}000) + 100{,}000}{12}$ = 8,500 Units per Month
- Resource planning
- Inventory planning
- Distribution requirements planning (DRP)
- Performance metrics and targets

Resource Planning

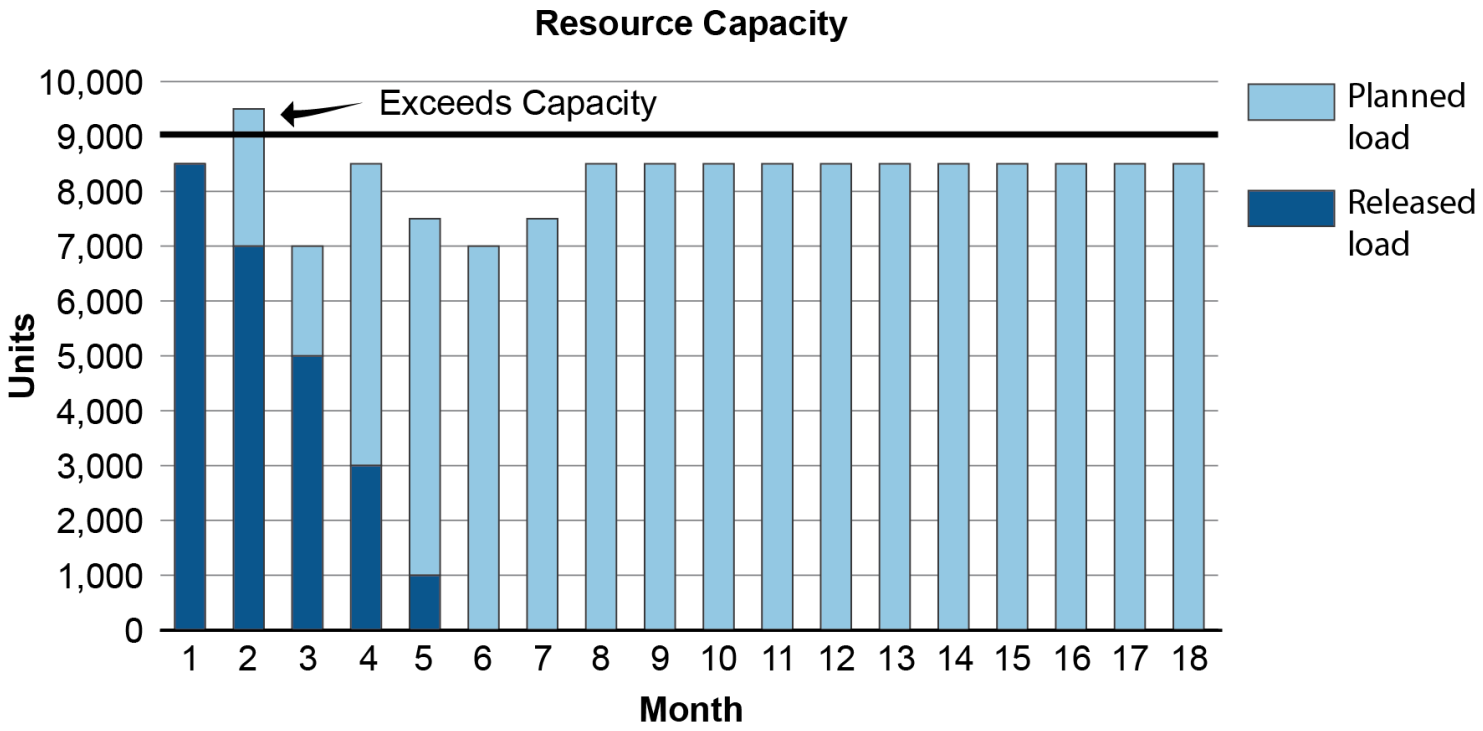
Resource Profile	Units	Capacity (Monthly)
Condenser shop	Hours	35,000
Final assembly	Cubic meters	8,000

Bill of Resources	Units	Family A	Family B	Family C
Condenser shop	Hours	3	5	5
Final assembly	Cubic meters	0.6	1.2	1.4

Resource Plan	Units	Family A	Family B	Family C	Total Load	Capacity	Load vs. Capacity
Jan. plan	Units	5,000	2,000	1,500	8,500		
Condenser shop	Hours	15,000	10,000	7,500	32,500	35,000	92.9%
Final assembly	Cubic meters	3,000	2,400	2,100	7,500	8,000	93.8%

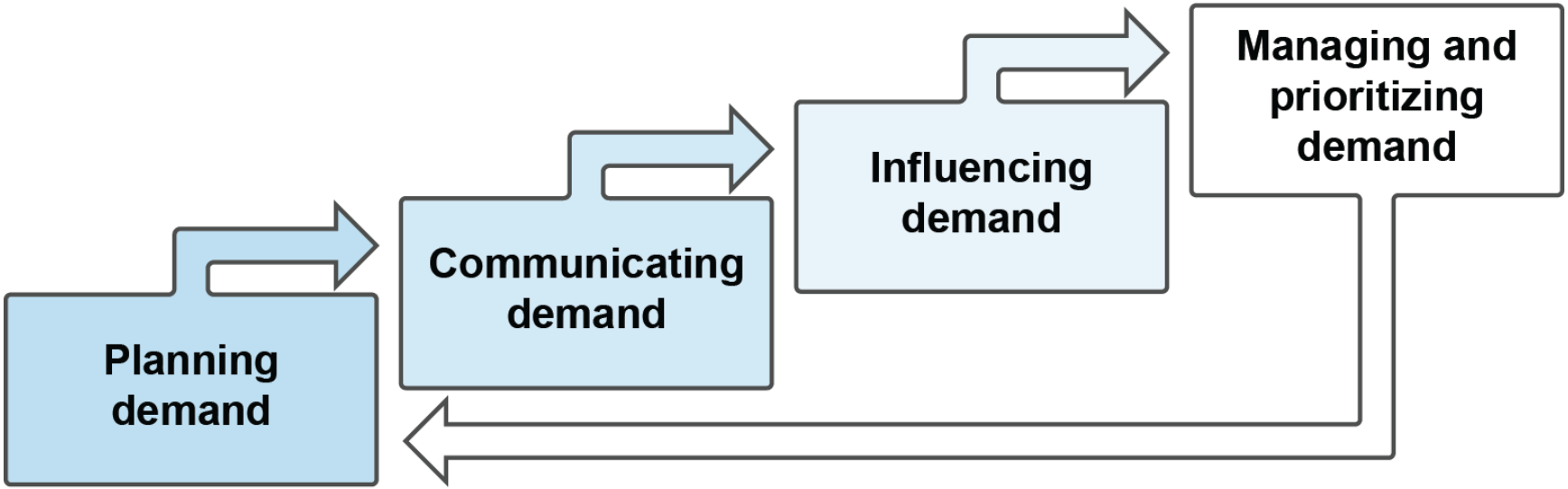
Source: Adapted from David F. Ross, *Distribution Planning and Control—Managing in the Era of Supply Chain Management,* third edition.

Fulfillment Center Capacity Bar Chart



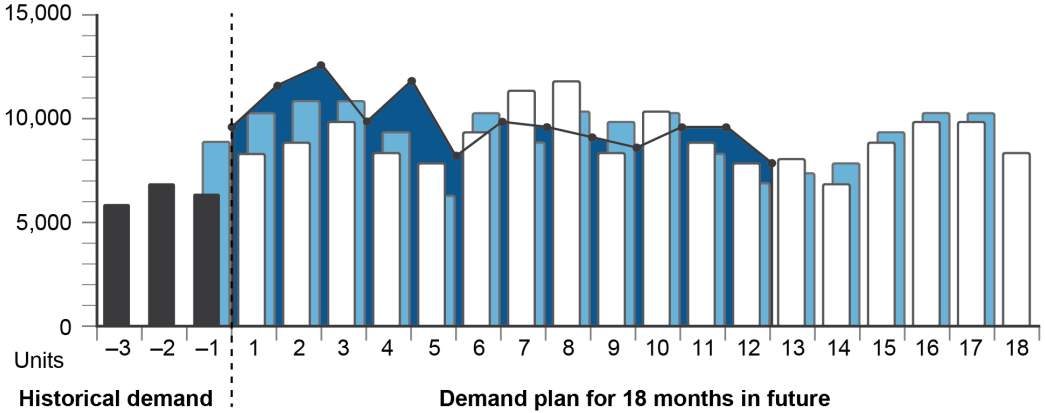
Contribute to the Demand Management Process

Demand Management Process



Contribute to the Demand Management Process

Demand Plan Dashboard: Units



Key:

- Actual demand
- Annual business plan
- Prior demand plan
- Current demand plan

Product family XYZ:

Lead time = 2 weeks

Inventory turnover = 2 weeks

Metrics (excerpt)		Historical Month		
Goal	Metric	–3	–2	–1
Delivery promises	On time in full	88%	86%	80%
Improve cash flow	Cash-to-cash	16d	13d	14d
Plan accuracy	Plan vs. actual	75%	80%	68%

Key assumptions

- **Internal:** Period 6 TV ad buy, results seen in Periods 6–8
- **External:** Competitor X will mimic Product XYZ feature ABC by Period 14 at lower price

Key events

- **Internal:** Period 1 deliveries delayed due to Machine 123 breakdown, will continue to delay in Period 1.
- **External:** Economic growth will continue to be flat for next 12 periods.

Risks/Opportunities

- **Risk:** Customer Z is vulnerable.
- **Opportunity:** Breakthrough in product development can reduce product replacement time by 3 months.

Decisions

- Rapid development of Product Family XYZ replacement for release in Period 14.

Contribute to the Demand Management Process

Demand Shaping: Influencing Demand

Support organization's business objectives.	Set strategic pricing.	Determine profitable product mix.
Support customer expectations and needs.	Develop products customers want.	Place at key distribution points.
Execute and control plan.	Promote products.	Adjust based on plan performance.

Contribute to the Demand Management Process

Demand Shaping: Managing and Prioritizing Demand

Internal balancing

- Production flexibility
- Safety stock
- Marketing methods
  - Sales incentives
  - Trade discounts
  - Consumer promotions

External balancing

- Price
- Lead time
- Product substitution
- Lost sale

Contribute to the Demand Management Process

Demand Shaping: Managing and Prioritizing Demand

- Supply and demand evaluate custom orders.
  - Management prioritizes, not salespersons.
  - Prioritize by customer value.
  - Policies for optimum profit and service.
  - Fulfill all demand if feasible + marginal profit.
- Management techniques
  - Rationing, queues, substitute incentives
  - Time fences: less oversupply
  - Scarce inventory at central supply longer

Incorporate Risk into Demand Management

- Integration
  - Supply chain visibility for demand exceptions
  - S&OP or integrated business planning (IBP)
- Forecasting
  - Error thresholds and corrections
  - Multiple horizons, aggregation
  - Range forecasting
- Contingency plans
- Diversify

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MODULE 2, SECTION C: TRANSLATE DEMAND INTO LOGISTICS CAPACITY PLANNING

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Forecast Logistics Demand

How Logistics Uses Sales Forecasts

3- to 5-Year forecast

- Size and number of warehouses
- Average shipments per shipping line

Annual forecast

- Staffing levels and equipment
- Capacity to book with carriers in RFP/ITT

Monthly forecast

- Worker, warehouse capacity constraints
- Number of payloads: minimum orders, weight restrictions

Forecast Logistics Demand

Logistics Demand using Forecasting Tools

- Long-term TL freight volume trends
- Product trends
- Weather, road/rail conditions
- Product return rates
- Cost escalation rates

Recognize the Role of Logistics Demand Shaping

Logistics Demand Shaping Strategies

B2B	B2C
▪ Purchase, shipment, and payment timing history ▪ Incentive or not? – Find customers who want to delay order – Discount for order in AM – Nonpeak discount – Forward shipping	▪ Free shipping may be expectation (competitors) ▪ Store credit for slow ship ▪ Free shipping subscription – Marketing tool – Incentive to wait for “full basket”

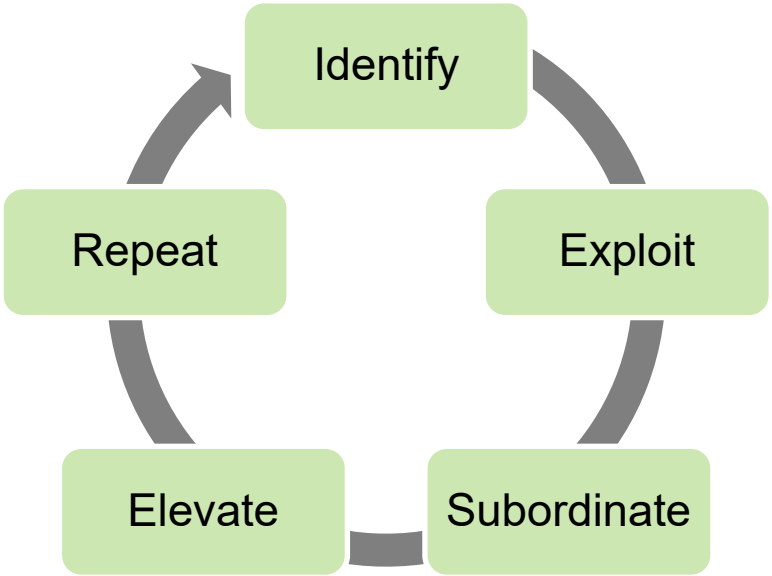
Conduct Transportation and Capacity Planning

Transportation and Warehouse Capacity

Planning Horizons

- Strategic
- Tactical
- Operational

Constraints Management to Optimize Capacity



Transportation Decisions

- Minimize partial loads.
- Reliability vs. lowest-cost carriers
- Ship or book capacity earlier.
- Inbound capacity:
  - Backscheduling
  - Can you transport cheaper than suppliers?
- Outbound capacity:
  - Annual requirement versus capacity

System Capacity, Throughput, and Load Planning

Capacity/throughput

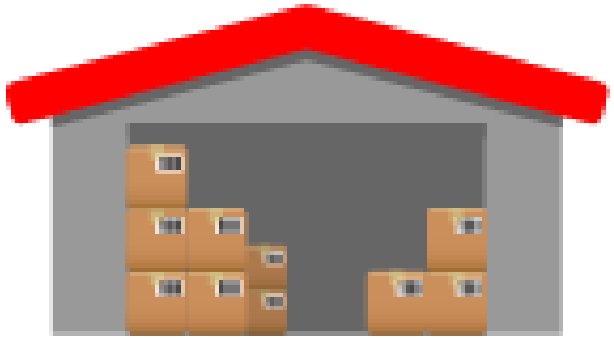
- Plan inbound and outbound jointly.
- Collaborative transportation management with partners and LSPs.

Load planning

- Calculate loads based on payload volume and weight limits.
- Break aggregate plan into weekly shipping schedule.
- Information on future requirements to plan ahead, not just react.

Warehousing Considerations

- Strategic decision—strong profitability impact
- Considerations:
  - Strategic forecast (long-term)
  - Warehouse usage mode
  - Storage capacity forecasting
  - Shipping and receiving dock needs
  - Equipment, labor, throughput constraints



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MODULE 2, SECTION D: SUPPORT SALES AND OPERATIONS PLANNING (S&OP)

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Learn the Sales and Operations Planning Process

Monthly Sales and Operations Planning Process

Step 1: Data gathering	Statistical forecast updated.
Step 2: Demand planning	Statistical forecast reviewed by product/brand, marketing, sales.
Step 3: Supply planning	Supply management team may alter operations plan if necessary.
Step 4: Pre-executive meeting	Key players review data, set executive meeting agenda.
Step 5: Executive meeting	VPs meet monthly to review decisions and strategy.

Supply Planning Phase Meeting

Supply/demand match

- Production plan matches demand plan.

Supply/demand mismatch

- Supply develops alternative plans:
  - Produce above demand to meet later spikes.
  - Increase capacity by hiring, adding shifts, planning overtime, leasing new equipment, or outsourcing (or opposite).
  - Reduce demand plan (last resort).

Learn the Sales and Operations Planning Process

CPFR®

	Manufacturer Tasks	Collaboration Tasks	Retailer Tasks
Strategy & Planning	• Account Planning • Market Planning	• Collaboration Arrangement • Joint Business Plan	• Vendor Management • Category Management
Demand & Supply Management	• Market Data Analysis • Demand Planning	• Sales Forecasting • Order Planning/ Forecasting	• POS Forecasting • Replenishment Planning
Execution	• Production & Supply Planning • Logistics/ Distribution	• Order Generation • Order Fulfillment	• Buying/Re-buying • Logistics/ Distribution
Analysis	• Execution Monitoring • Customer Scorecard	• Exception Management • Performance Assessment	• Store Execution • Supplier Scorecard

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TRANSPORTATION AND DISTRIBUTION

MODULE 2, SECTION E: SUPPORT DISTRIBUTION REQUIREMENTS PLANNING (DRP)

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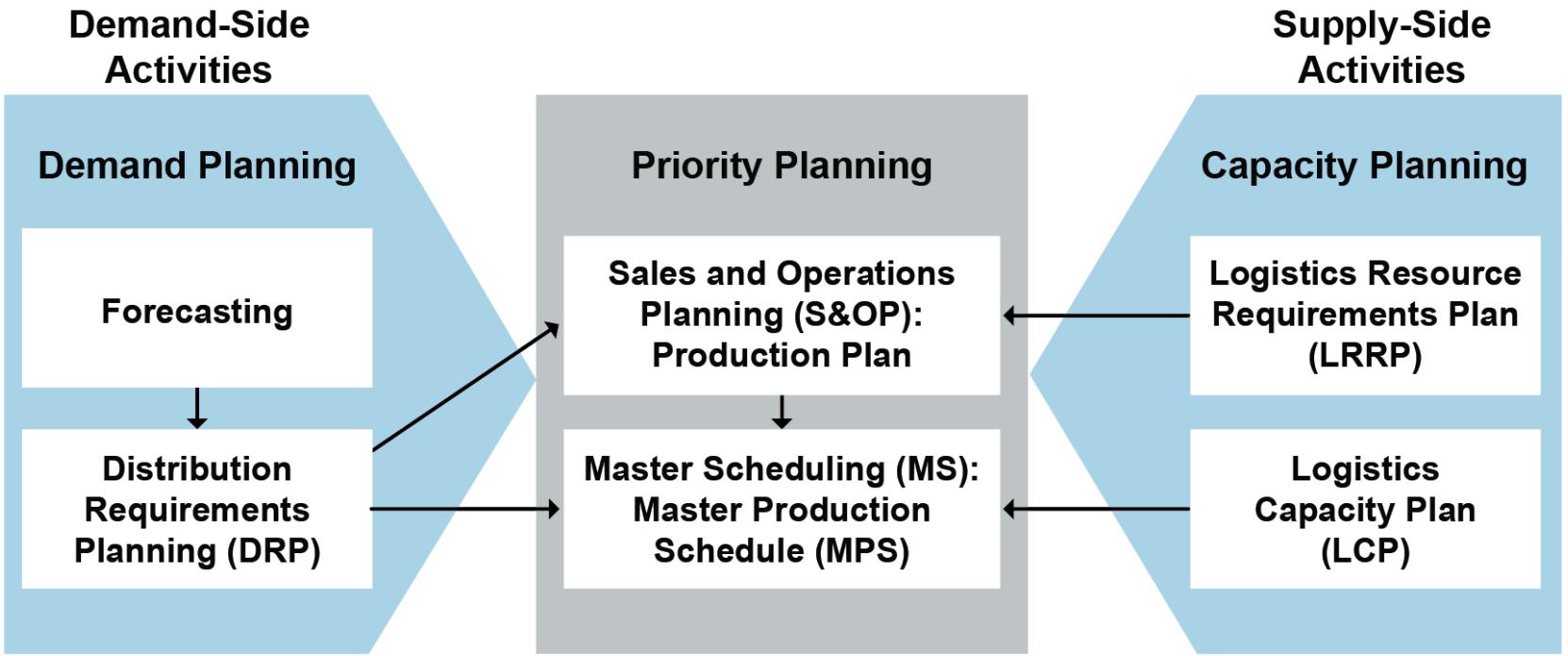
Logistics Planning and Control



Inventory Planning

$$\text{Production Rate} = \frac{(\text{Ending Inventory} - \text{Beginning Inventory}) + \text{Forecast}}{\text{Number of Periods}}$$

$$= \frac{(1{,}000 - 1{,}500) + (5{,}200 + 5{,}400 + 4{,}900)}{3} = 5{,}000 \text{ Units per Month in Q1}$$

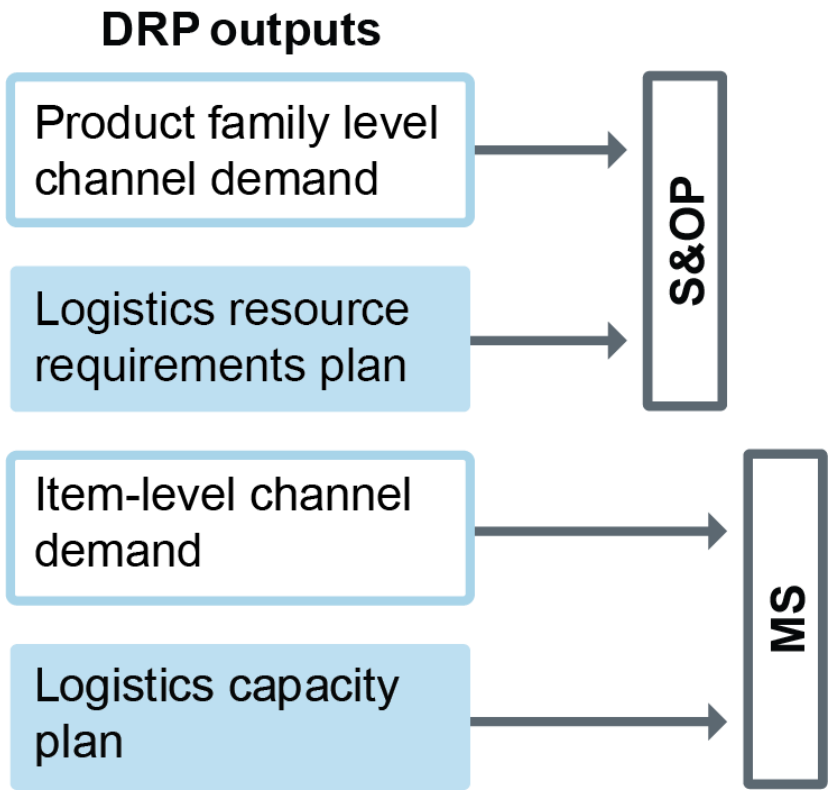
Family (in units), Family A, Mini-Refrigerator								
Period	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Forecast		5,200	5,400	4,900	4,700	4,800	5,100	5,000
Production plan		5,000	5,000	5,000	5,033	5,033	5,033	6,667
Ending inventory plan	1,500	1,300	900	1,000	1,333	1,567	1,500	3,167
Qtr. inventory target				1,000			1,500	
Max inventory (OK?)	2,000	OK	OK	OK	OK	OK	OK	FIX
Min inventory (OK?)	1,000	OK	FIX	OK	OK	OK	OK	OK

Source: Adapted from David F. Ross, *Distribution Planning and Control – Managing in the Era of Supply Chain Management,* third edition.

Conduct LRRP and LCP

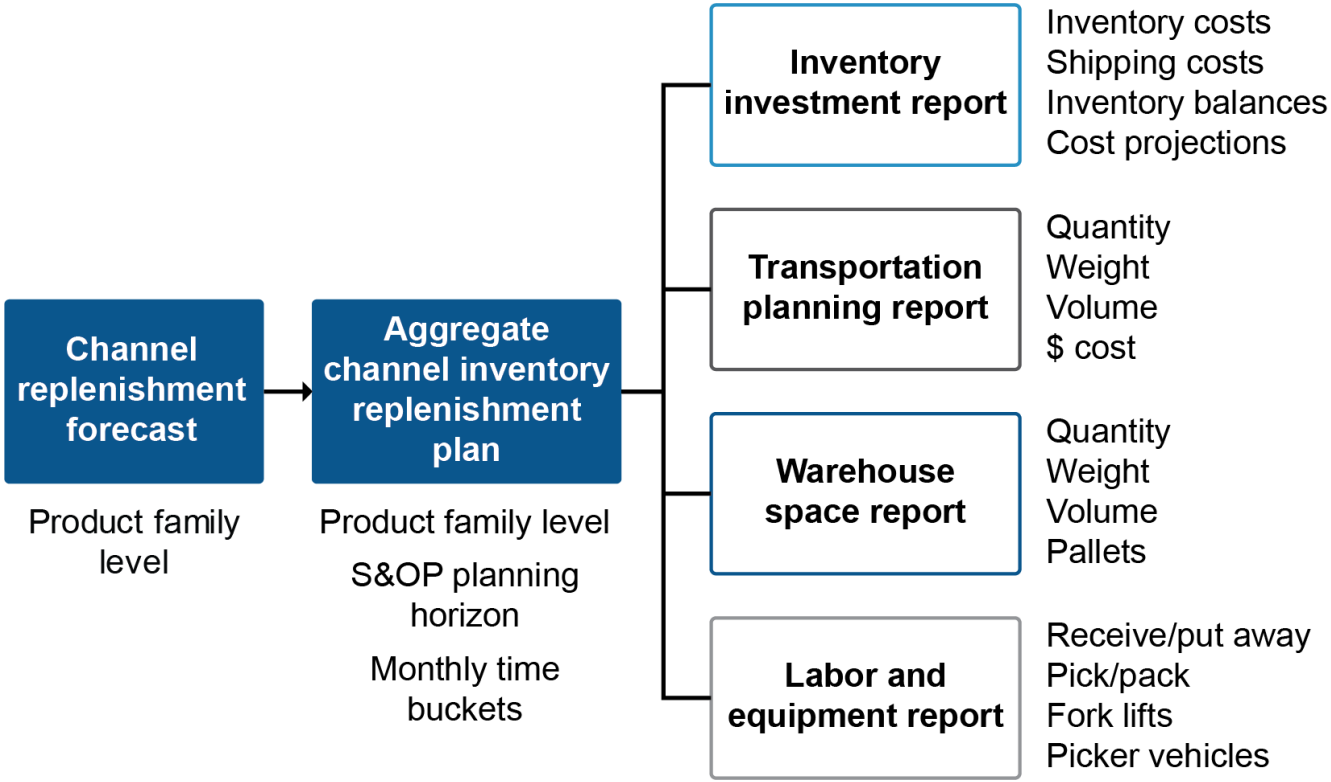
Links to S&OP and MS

Demand inputs:
Forecasts needed at two levels in DRP (the two white boxes)



Conduct LRRP and LCP

LRRP Information Flow



Conduct LRRP and LCP

LRRP Elements

Report	Description
Inventory investment	• Financial resource adequacy • Aggregate costs over horizon • Product family replenishment and shipping costs
Transportation planning	• DC transportation requirements • Transportation unit factors and product family shipping profiles
Warehouse space	• Space required based on above reports and shipping profiles
Labor and equipment	• Aggregate labor/equipment at DCs • Aggregate standards for unloading, put-away, etc.

Conduct LRRP and LCP

Logistics Capacity Planning/Plan

Operation-level capacity check

Inputs

- Unit-level short-term forecasts
- Current customer order backlogs
- Pending customer backorders

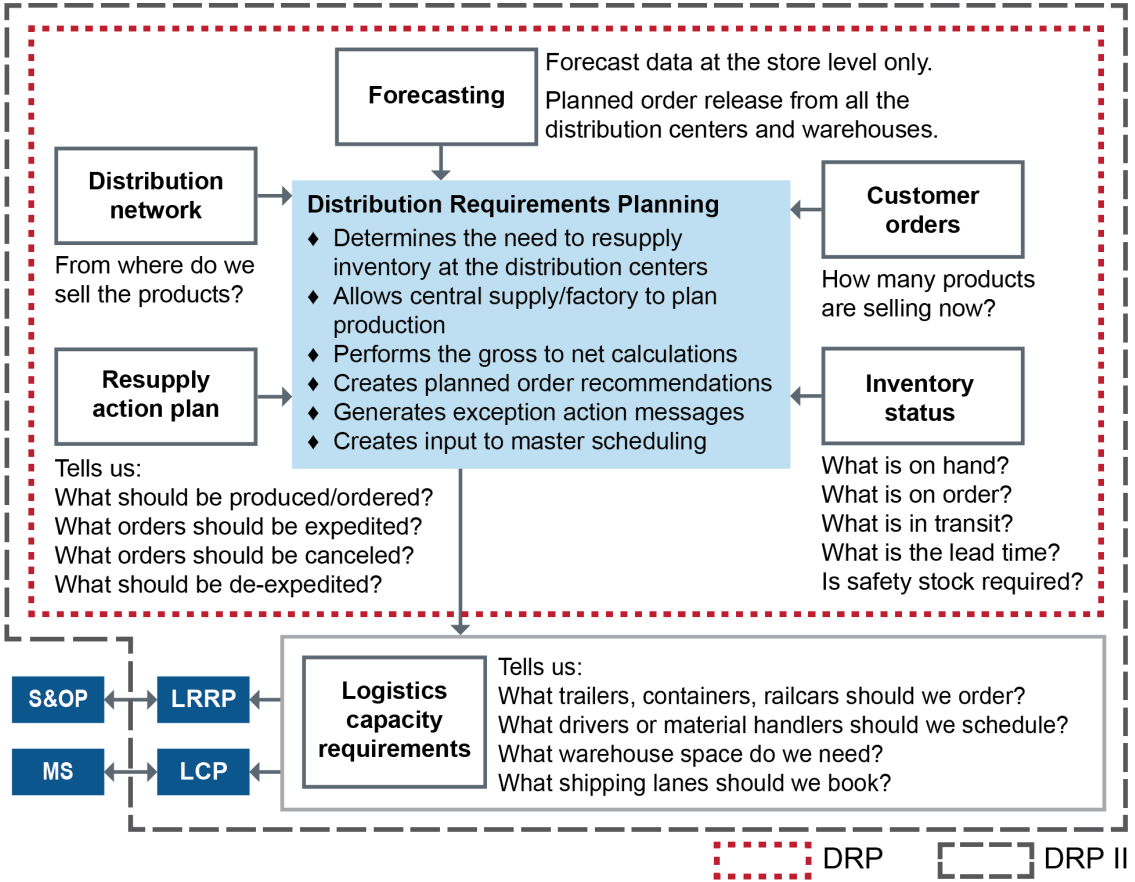
Outputs

- Unit-level shipping and storage plan
- Financial impacts of changes in logistics plans or MPS

Understand DRP Process, Logic, and Ordering Policies

DRP and DRP II

- Replenish inventory at distribution centers
- DRP output used in DRP II for logistics capacity



Understand DRP Process, Logic, and Ordering Policies

Distribution Requirements Planning

Push systems	Hybrid systems (DRP)	Pull systems
▪ Forecasts and schedules centrally coordinated. ▪ Customers don't determine own orders. ▪ Doesn't account for local conditions.	▪ Push to given echelon, pull from there, use retail demand data. ▪ Coordination and control. ▪ Responsive to local demand.	▪ Partners determine own orders. ▪ Bullwhip effect if partners don't collaborate. ▪ Doesn't account for needs of other SC partners. ▪ Ignores supplier's ability.

DRP Grid, Prior to Planned Orders

Safety stock: 0 units
Min. order quantity: 50 units
Lead time: 2 weeks
Lot size: 50 units

PAB = Beginning Inventory or Prior Period PAB + Scheduled Receipts + Planned Order Receipts – Gross Requirements

DRP Grid							
Week		**1**	**2**	**3**	**4**	**5**	**6**
Gross Requirements		110	110	110	110		
Scheduled Receipts			100				
Projected Available Balance	170	60	50	–60	–170		
Net Requirements		0	0	60	170		
Planned Order Receipts		0	0				
Planned Order Releases		0	0				

DRP Grid, with a Planned Order

Safety stock: 0 units
Min. order quantity: 50 units
Lead time: 2 weeks
Lot size: 50 units

Net Requirements = Gross Requirements – Scheduled Receipts – Beginning Inventory or Prior Period PAB + Safety Stock

DRP Grid							
Week		**1**	**2**	**3**	**4**	**5**	**6**
Gross Requirements		110	110	110	110		
Scheduled Receipts			100				
Projected Available Balance	170	60	50	40	–70		
Net Requirements		0	0	60	70		
Planned Order Receipts		0	0	100			
Planned Order Releases		100	0				

DRP Grid, Completed

Safety stock: 0 units
Min. order quantity: 50 units
Lead time: 2 weeks
Lot size: 50 units

Given safety stock, planned order receipts and corresponding releases would be scheduled whenever PAB will go below minimum safety stock level (not when it will go negative).

DRP Grid							
Week		**1**	**2**	**3**	**4**	**5**	**6**
Gross Requirements		110	110	110	110	110	110
Scheduled Receipts			100				
Projected Available Balance	170	60	50	40	30	20	10
Net Requirements		0	0	60	70	80	90
Planned Order Receipts		0	0	100	100	100	100
Planned Order Releases		100	100	100	100	100	150

DRP Logic

(Lead time = 1 week)

DC A: Week		~	6	7
Gross Reqs.				300
PAB	170		170	270
Net Requirements				200
Planned Order Receipts				400
Planned Order Releases			400	

(Lead time = 2 weeks)

DC B: Week		~	6	7	8
Gross Reqs.					500
PAB	200		200	200	200
Net Requirements					400
Planned Order Receipts					500
Planned Order Releases			500		

Central Supply: Week		~	3	~	5	6	7
Gross Reqs.						900	
PAB	500		500		500	200	200
Net Requirements						600	
Planned Order Receipts						600	
Planned Order Releases			600				

(Lead time = 3 weeks)

MS Grid: Week		~	2	3	4
Gross Reqs.				600	
PAB			0	200	200
MPS				800	

Lot sizes: **DC A: 400**
DC B: 500 **Central: 600**
Safety stock: **DC A: 70** **DC B: 100**
Central: 200

Source: *APICS CPIM Basics of Supply Chain Management*

Exceptions and Action Messages

- Releases
- Lead-time violations
- Cancel notices
- Expedite scheduled receipts
- De-expedite scheduled receipts

DRP and Inventory Ordering Policies

- Lot-for-lot (discrete)
  - Lot-for-lot above minimum quantity
  - Lot size quantities
- Fixed period requirements
- Min-max
- Economic order quantity

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MODULE 2, SECTION F: UNDERSTAND MASTER SCHEDULING AND MATERIAL REQUIREMENTS PLANNING

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Enterprise Resources Planning: Logistics Files

- Customer files
- Product-price files
- Supplier files
- Open order files
- Purchase order (PO) files
- Bill of material files
- Inventory files
- Order and PO history files
- Warehouse and DC files
- Carrier files

Use ERP and Execution Systems

Supply Chain Execution Systems

Advanced Planning and Scheduling (APS) Systems

- Coordinate multiple production facilities
- Constraints, finite capacity
- Includes: Demand planning, production planning, production scheduling, distribution planning, and transportation planning
- Alternatives for costs/profit optimization

Other Execution Systems

- Supply chain control towers
- WMS
- Order management systems
- Distributed order management
- TMS
- Global trade management
- Manufacturing execution

Controlling Priorities: The Master Schedule

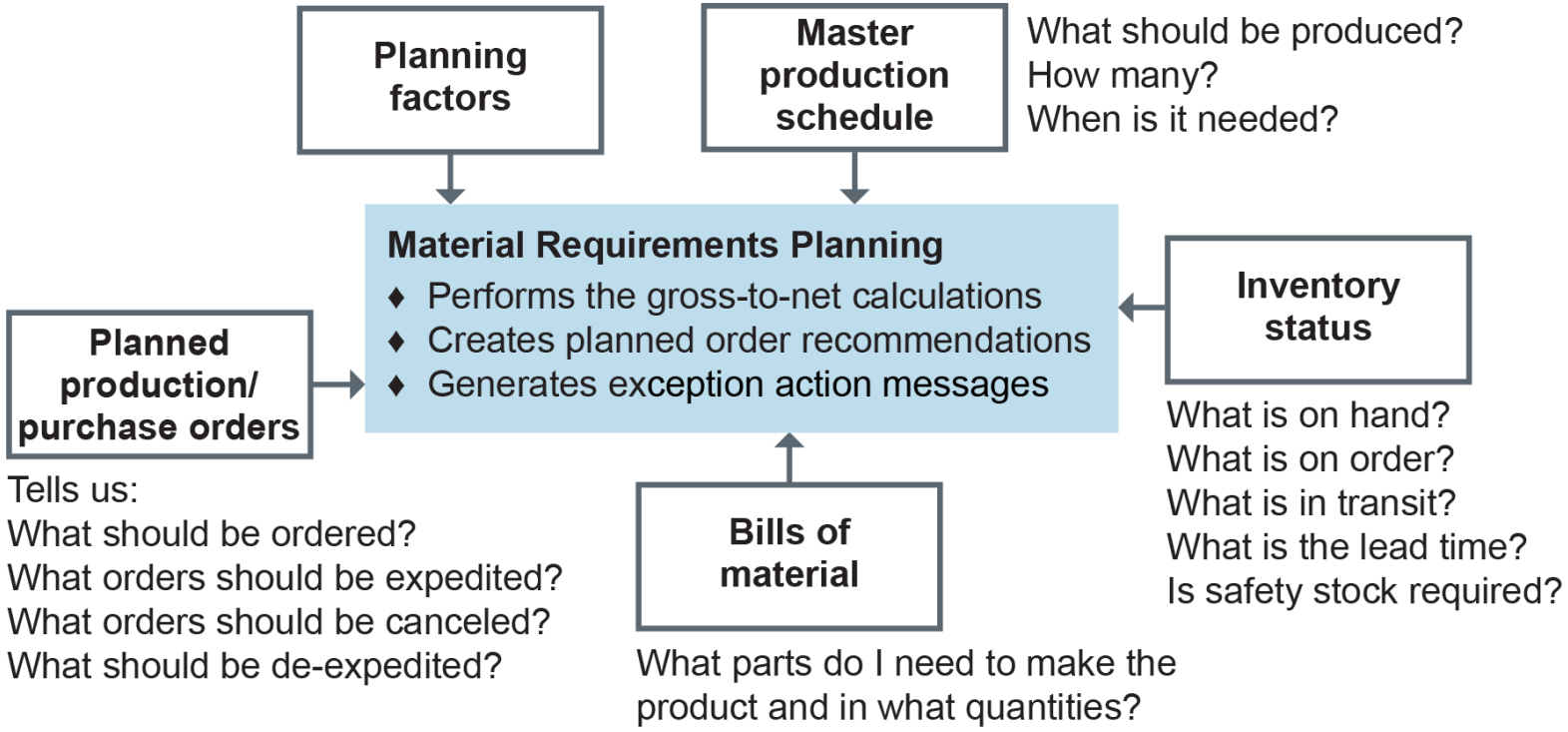
		Frozen zone			Slushy zone					Liquid zone	
Period		1	2	3	4	5	6	7	8	9	10
Forecast		20	22	21	25	24	23	21	21	25	25
Customer orders		19	17	15	11	9	5	2	1	0	0
Projected available balance (PAB)	50	31	14	49	24	0	27	6	35	10	35
Available-to-promise (ATP)		14		15			43		49		
Master production schedule (MPS)				50			50		50		50

Demand Time Fence

Planning Time Fence

Source: *APICS Master Planning of Resources*, Version 3.1

Materials Requirements Planning



CLTD

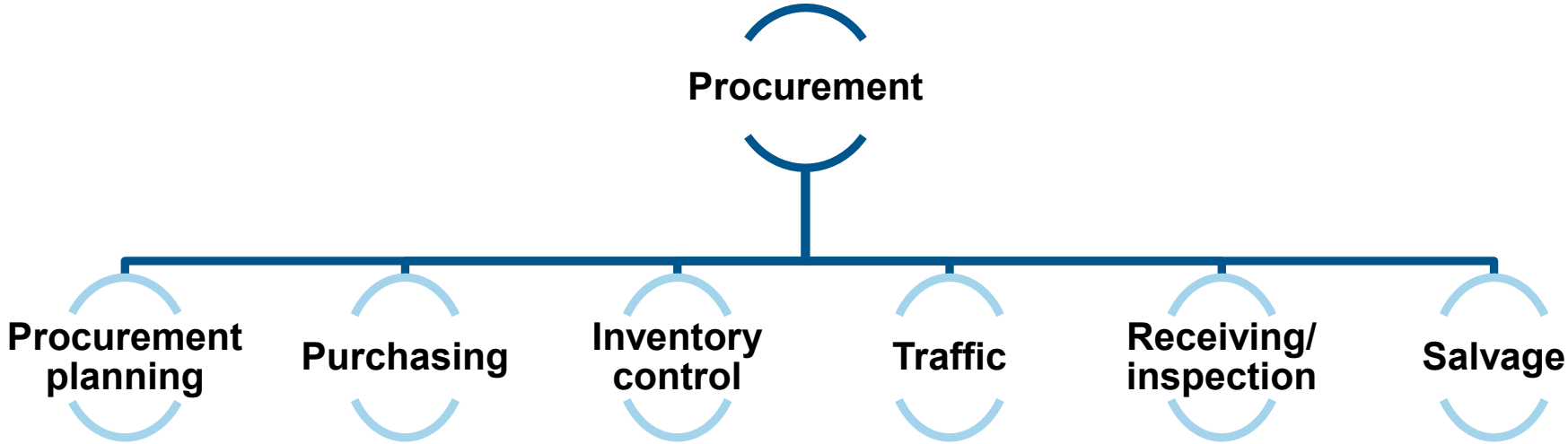
CERTIFIED IN LOGISTICS,
TRANSPORTATION AND DISTRIBUTION

MODULE 2, SECTION G: FACILITATE SOURCING AND PROCUREMENT

APICS

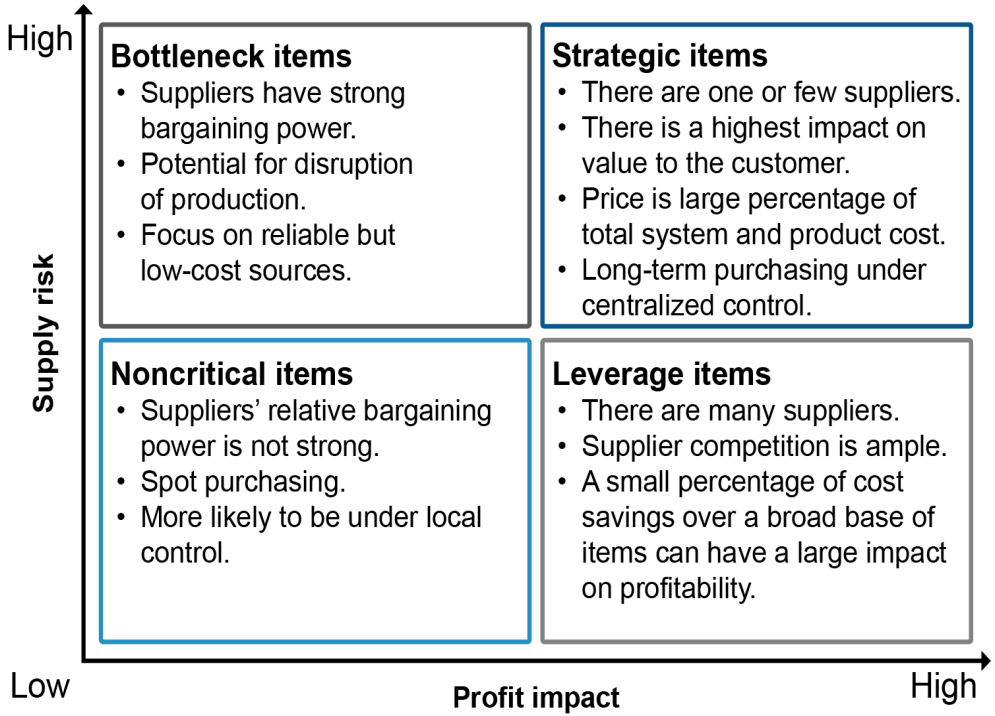
ascm

Procurement Organizational Structure



Procurement Strategy

- Spend analysis
- Strategic sourcing
  - High reliability and quality
  - Lowest total cost of ownership (TCO)
  - Multisource over single-source or sole source if possible



Use a Procurement Process

Selecting and Managing Suppliers

Selecting suppliers

- Identify direct/indirect material purchasing requirements.
- Set price, quantity, functionality, and esthetics.
- Identify potential suppliers.
- Specify evaluation criteria and weights.
- Issue RFP/ITT.
- Rank and select candidates.
- Negotiate price and service levels.
- Review terms/conditions and sign contracts.

Managing suppliers

- Issue purchase orders.
- Monitor and control deliveries.
- Receive and accept goods and pay invoices.
- Continually improve supplier performance.

Use a Procurement Process

Weighted Selection Criteria

*Inventory carrying cost based on necessary ordering interval

Landed Cost	Rating	Supplier A		Supplier B		Supplier C	
Price		$2,200		$3,200		$2,000	
Transportation cost		$800		$500		$1,400	
Inventory carrying cost*		$400		$200		$600	
Total landed cost		$3,400		$3,900		$4,000	
Rank/weighted rank	15%	5	**0.75**	2	**0.30**	1	**0.15**
Value Factors							
Technical capability	10%	2	**0.20**	4	**0.40**	5	**0.50**
Capacity	10%	5	**0.50**	3	**0.30**	3	**0.30**
Reliability	10%	2	**0.20**	2	**0.20**	3	**0.30**
Flexibility	5%	2	**0.10**	4	**0.20**	5	**0.25**
Agility	5%	4	**0.20**	5	**0.25**	2	**0.10**
Collaboration	10%	3	**0.30**	3	**0.30**	4	**0.40**
Quality	5%	1	**0.05**	2	**0.10**	5	**0.25**
Rank/weighted rank			**1.55**		**1.75**		**2.10**
Risks							
Availability	10%	2	**0.20**	3	**0.30**	4	**0.40**
Lead time	15%	3	**0.45**	4	**0.60**	4	**0.60**
Price change	5%	5	**0.25**	2	**0.10**	1	**0.05**
Rank/weighted rank	100%		**0.90**		**1.00**		**1.05**
Cumulative weighted rank			**3.20**		**3.05**		**3.30**

Principled Negotiation Tactics: Win/Win

Negotiations should:	Agreements should:
▪ Efficiently solve underlying issues. ▪ Preserve or increase positive relationships.	▪ Persist. ▪ Meet both parties' actual needs. ▪ Resolve conflicts of interest fairly. ▪ Be in the community's interests.

Contracts

- Contracts for the international sale of goods (CISG)
- Cost-based
  - Cost-plus-fixed-fee
- Fixed price
  - Firm fixed-price
- Incentives
  - Cost-plus-incentive-fee
  - Fixed-price-incentive-fee

Contract Terms and Conditions

- Good faith
- Term, scope, territory, corporate account
- Pricing, delivery
- Trade/payment/order terms
- Performance, quality
- Incentives and penalties
- Status reporting
- Problem resolution, termination
- Security, intellectual property, nondisclosure
- Language, legal authority
- Indemnification
- “Entire agreement supersedes”
- “Executed in counterparts”

U.S. Domestic Terms of Sale and Trade

	Freight Charges Paid By	Ownership in Transit	Files Freight Claims
FOB Origin, Freight Collect	Buyer	Buyer	Buyer
FOB Origin, Freight Prepaid	Seller	Buyer	Buyer
FOB Origin, Freight Prepaid and Charged Back	Seller (but invoices buyer)	Buyer	Buyer
FOB Destination, Freight Collect	Buyer	Seller	Seller
FOB Destination, Freight Prepaid	Seller	Seller	Seller
FOB Destination Freight Prepaid and Charged Back	Seller (but invoices buyer)	Seller	Seller

Supplier Performance Management: KPIs, Metrics

- Suppliers should participate.
- Act on failures.
- Formal and informal communications.
- Supplier scorecard—dashboard with weightings:
  - Magnitude of cost savings
  - Variances from price, quantity, type, timing, quality
  - Benchmark prices
  - Magnitude and frequency of early and late deliveries
  - Sustainability, ethics
  - Supplier certification