CSCP CERTIFIED SUPPLY CHAIN PROFESSIONAL

MODULE 1: SUPPLY CHAINS, DEMAND MANAGEMENT, AND FORECASTING

SECTION A: INTRODUCTION TO SUPPLY CHAINS

APICS ASCM

Section A Introduction

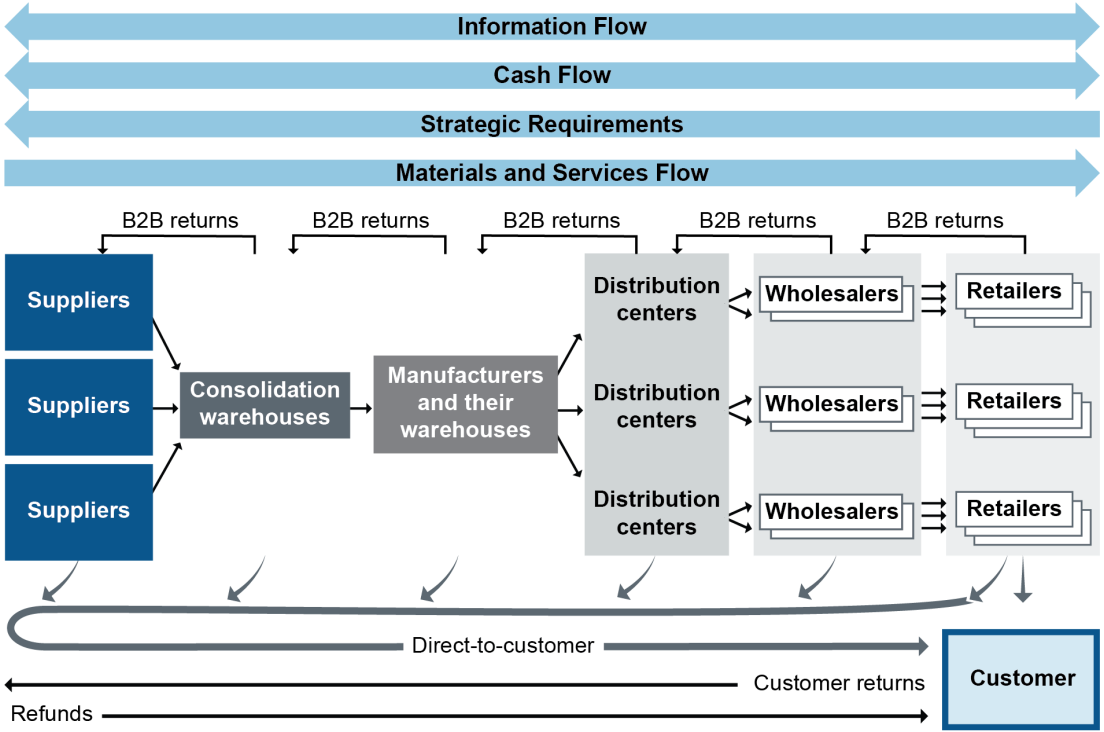
Section A Key Processes:

- Design the supply chain network.
  - Flow of product, information, and funds

Section A Topics:

- Supply Chain Models
- Supply Chain Maturity and Complexity

Basic Supply Chain for a Product

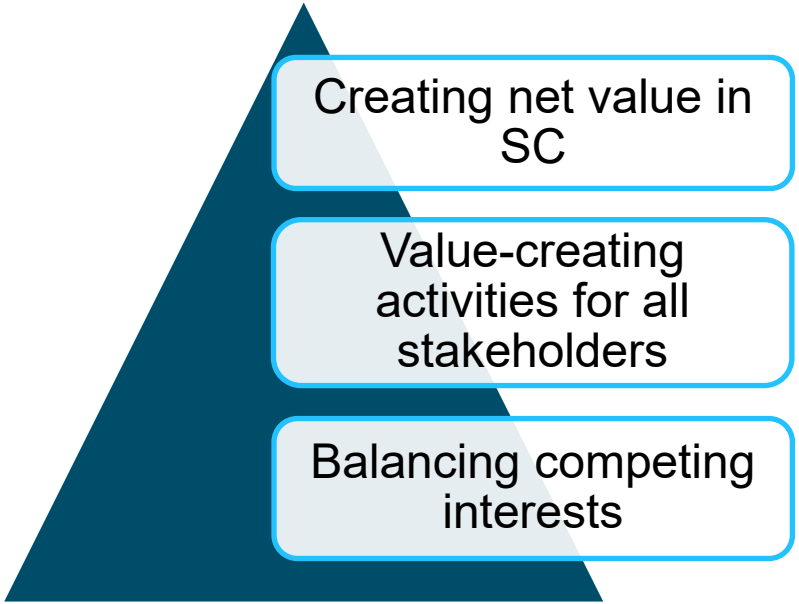


Funds Flows, Value, and Balance

Funds Flows

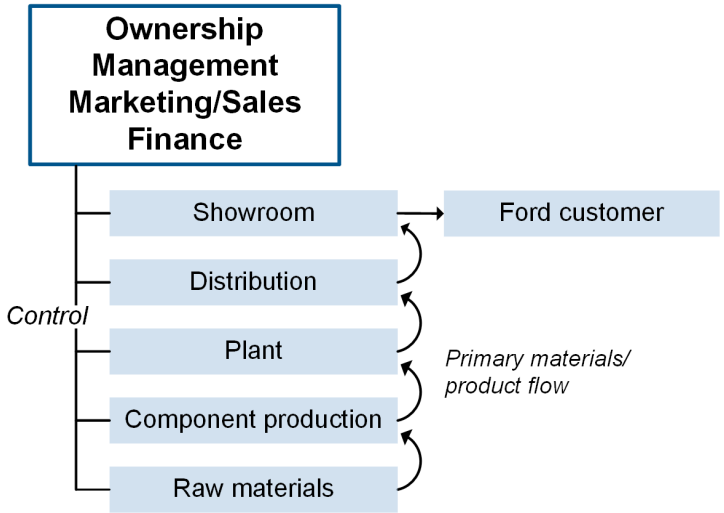
- Goes upstream: customer > producer > supplier.
- Not linear.
- E-payments reduce cash-to-cash cycle time.
- Better customer-supplier relationships
- Fewer imbalances between larger and smaller players.

Value and Balance



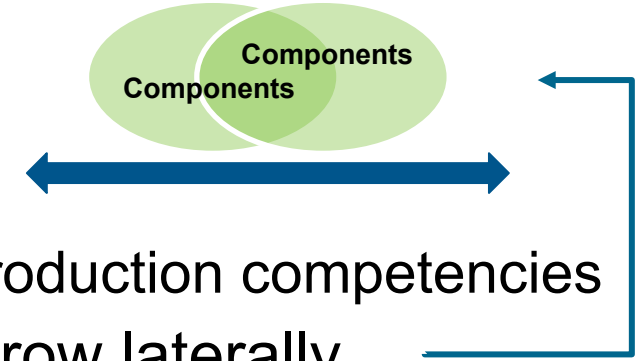
Vertical Integration

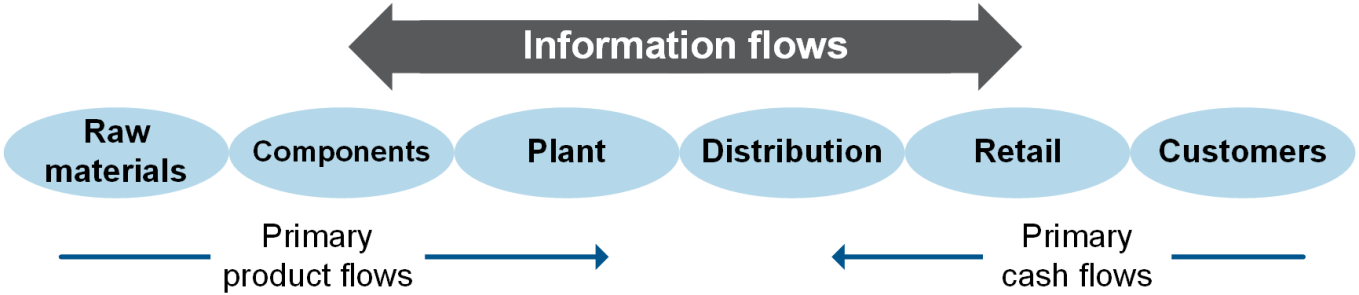
- Benefits of vertical integration
  - No dealing with competitors for supplies, etc.
  - Enhanced visibility into operations
  - Same ownership and management for all activities in supply chain
- Ford: historic example
- McDonald's doesn't directly own its supply chain, but:
  - Long-term supply contracts
  - Vested interest model
  - 100% landowner of all sites
  - Significant control



Lateral (Horizontal) Integration

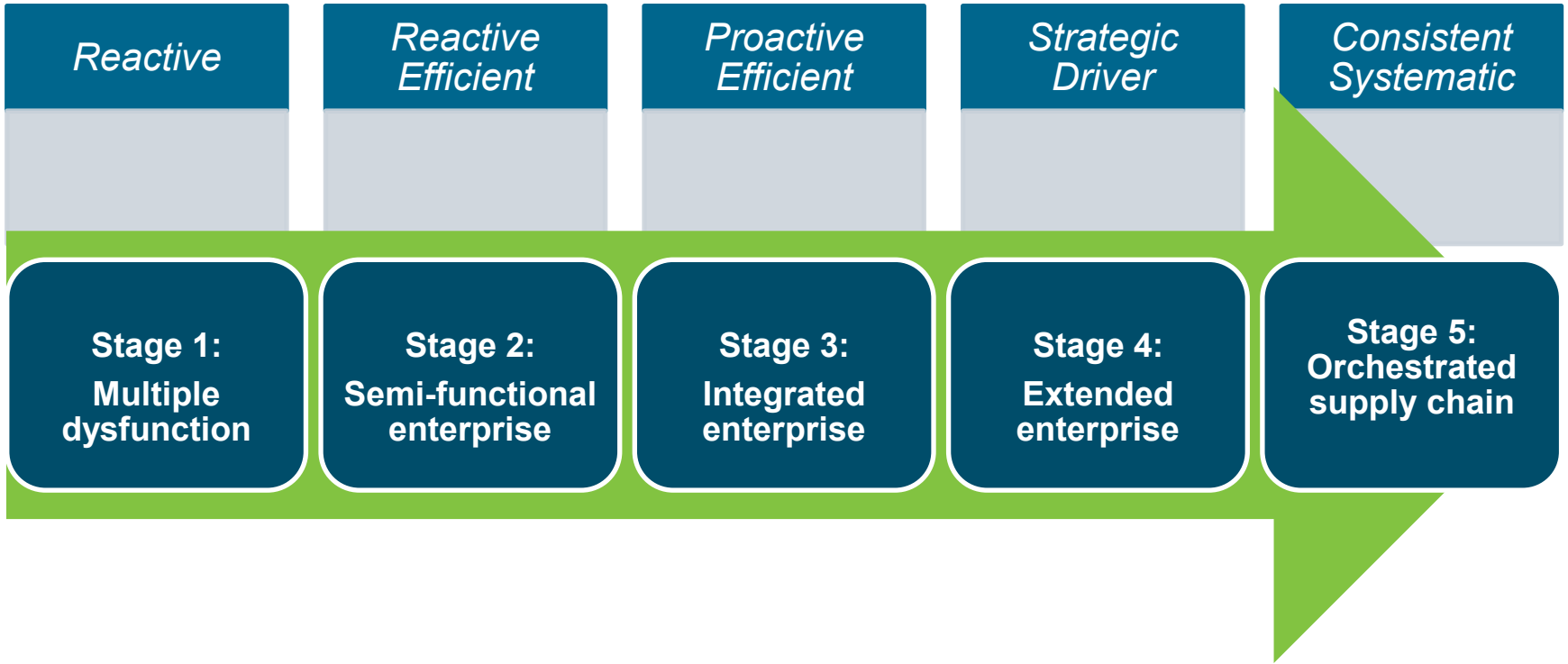
- Benefits of lateral integration
  - Economies of scale and scope
  - Improved business focus
  - Leveraging communication and production competencies
- Lateral mergers are one way to grow laterally.





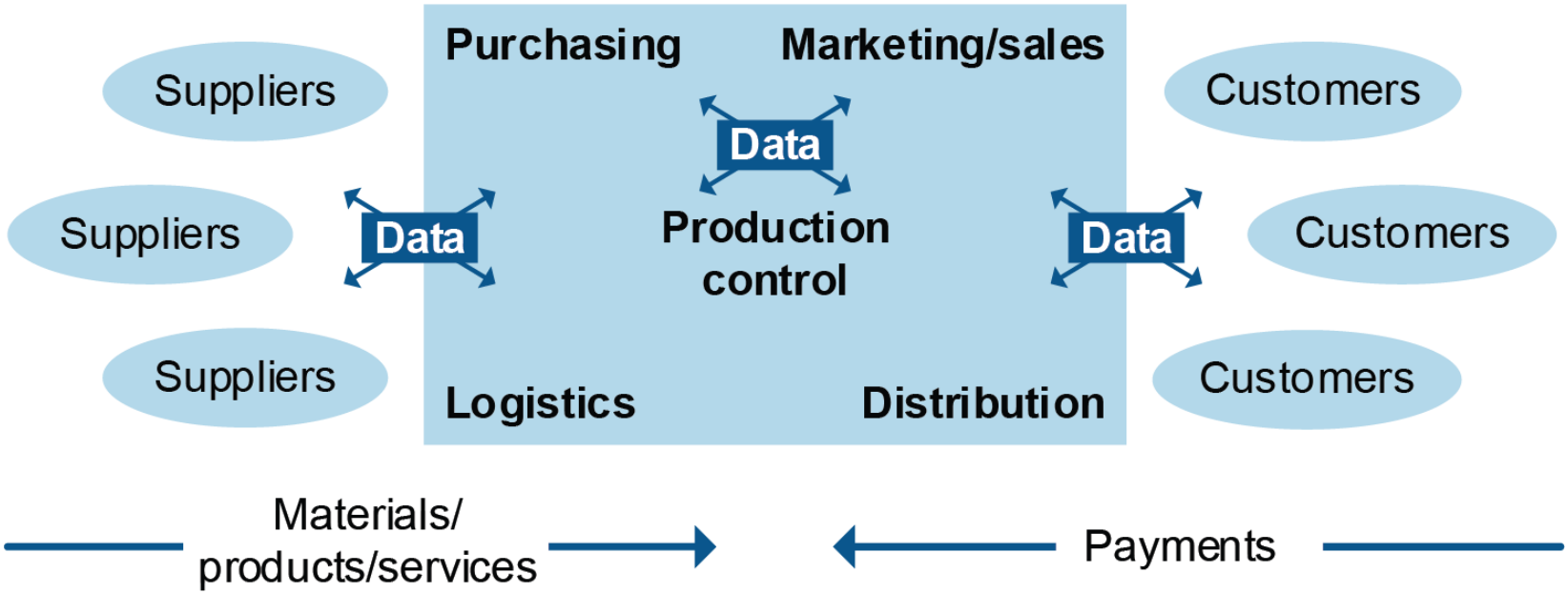
Supply Chain Maturity and Complexity

Supply Chain Stages



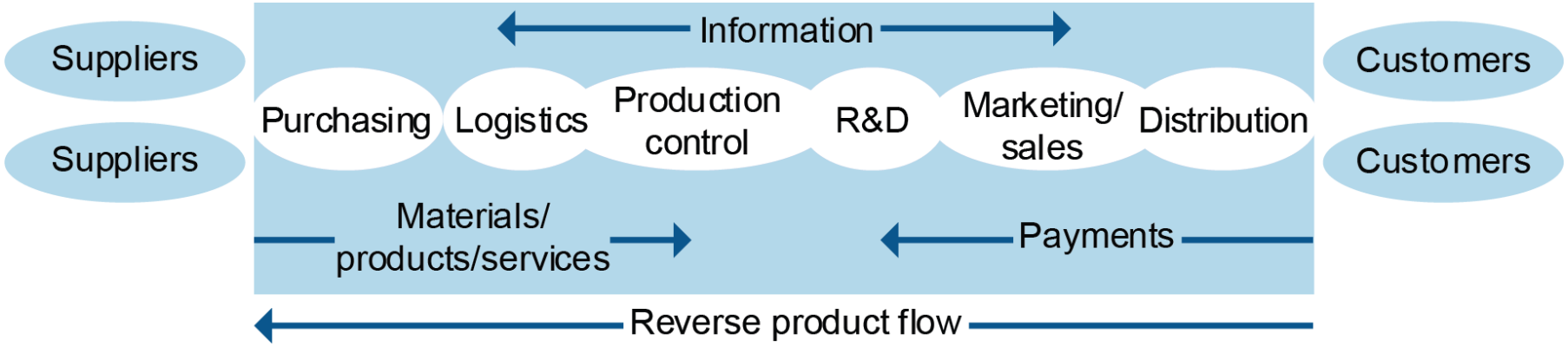
Supply Chain Maturity and Complexity

Stage 1: Multiple Dysfunction

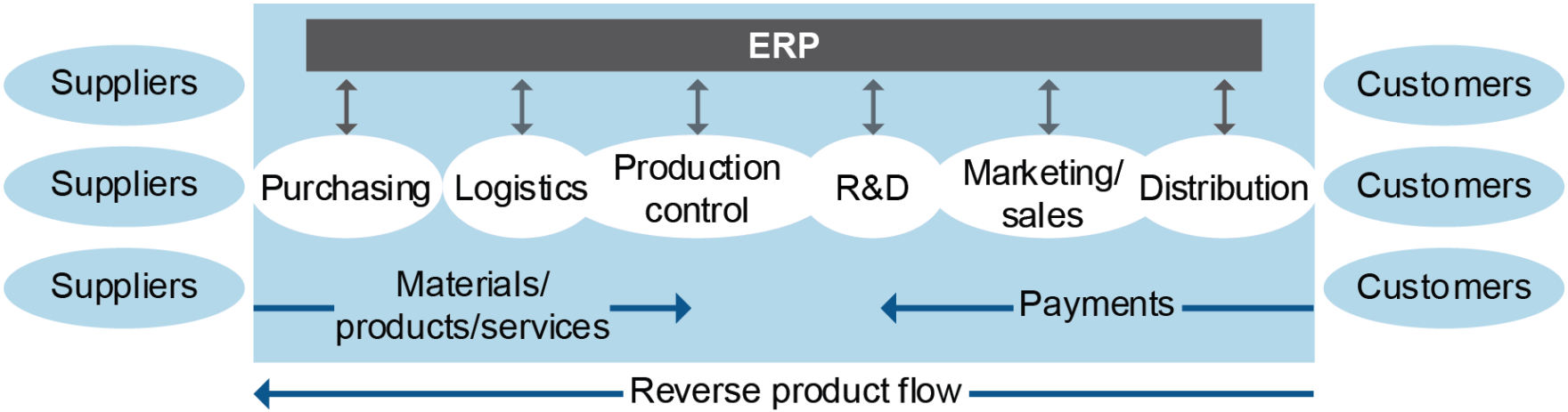


Supply Chain Maturity and Complexity

Stage 2: Semifunctional Enterprise

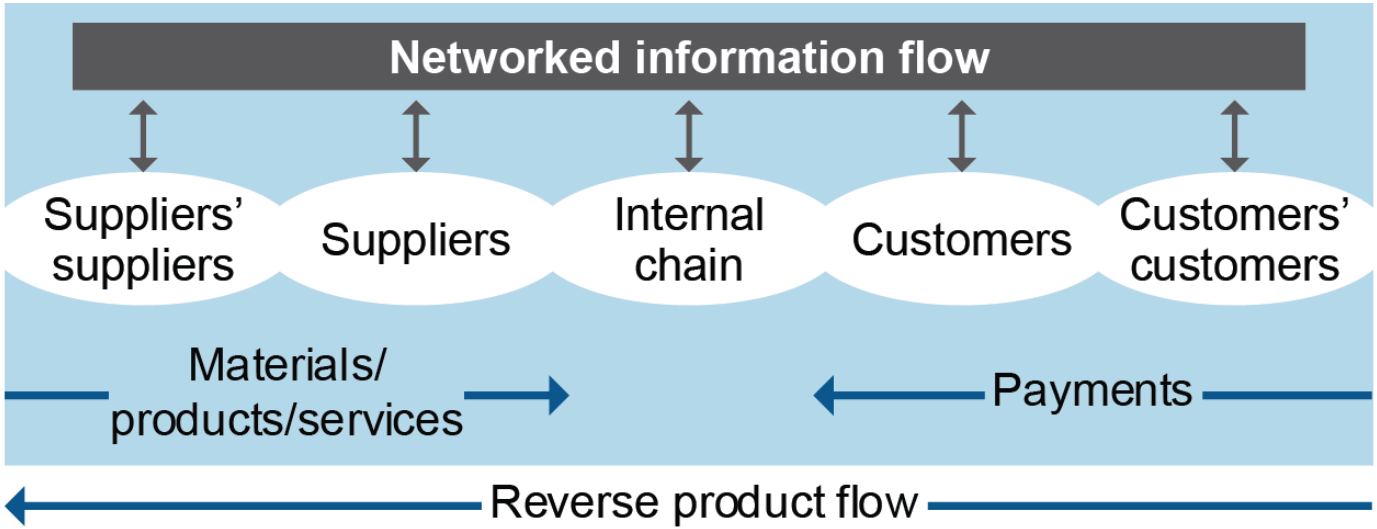


Stage 3: Integrated Enterprise



Supply Chain Maturity and Complexity

Stage 4: Extended Enterprise

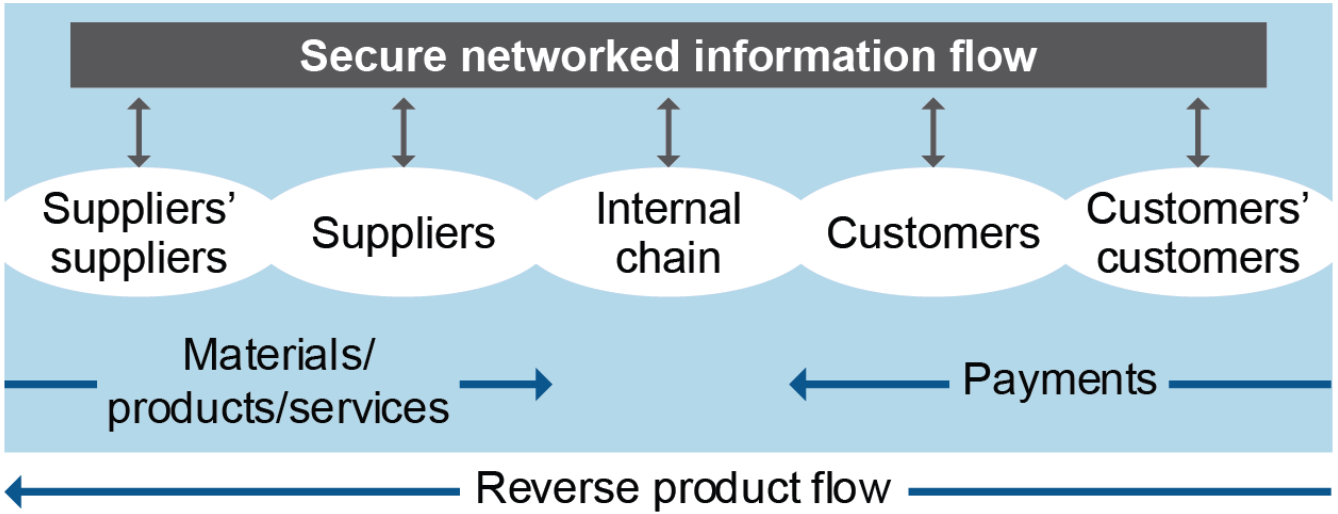


Stage 5: Orchestrated Supply Chain

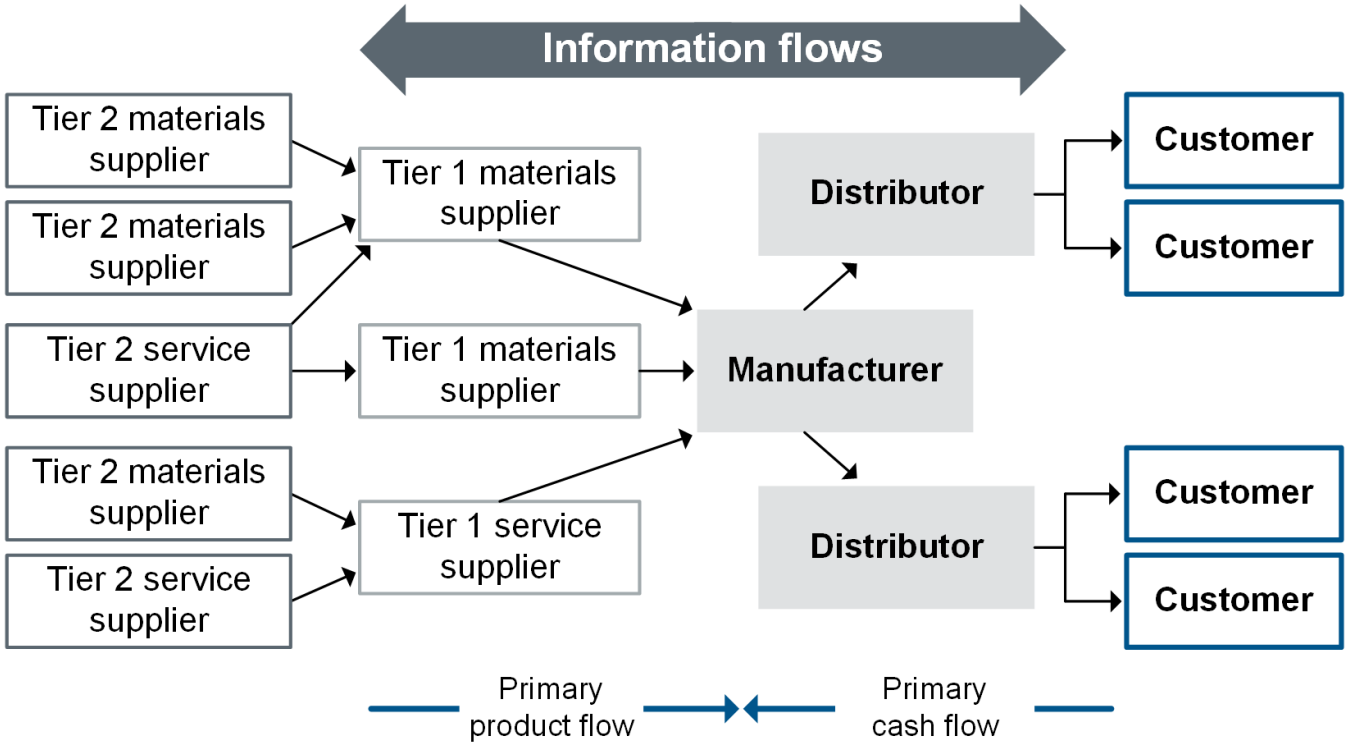
Data-driven ♦ Team-driven

Resiliently sourced ♦ Inclusively designed ♦ Change-ready

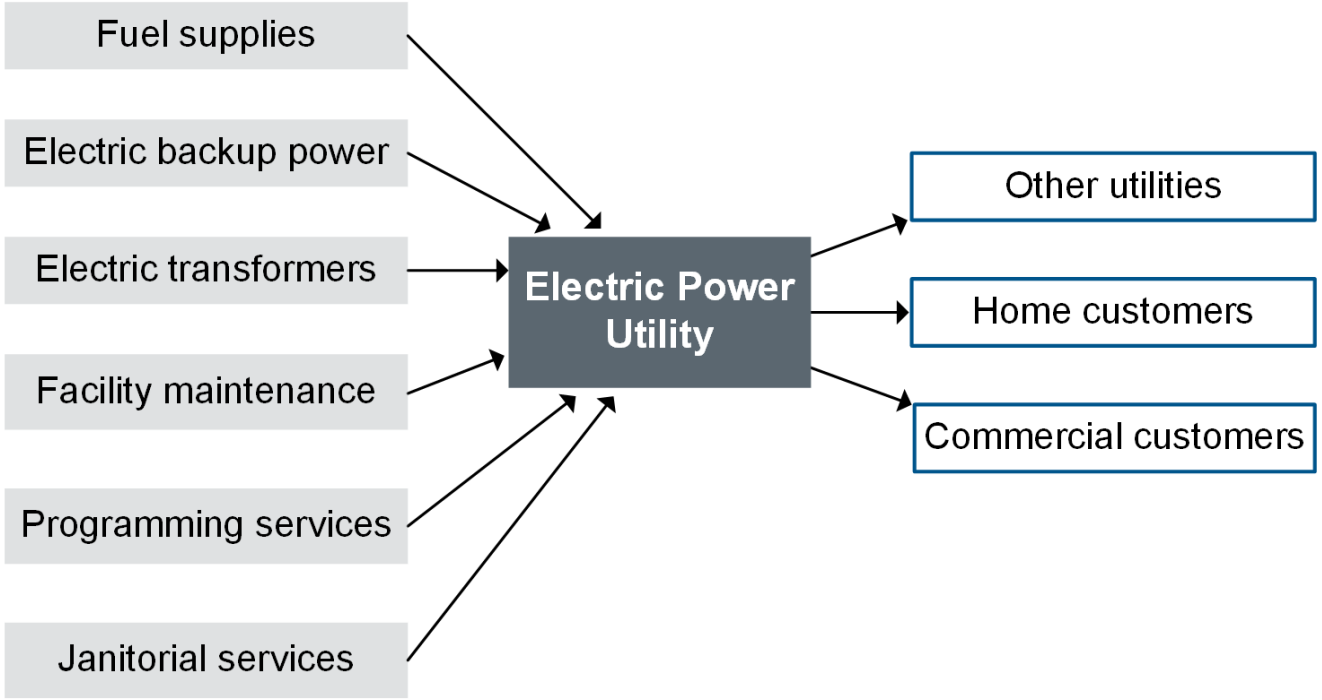
Gaps addressed for end-to-end visibility and process automation



Manufacturing Supply Chain Model



Services Also Have Supply Chains



Supply Chain Maturity and Complexity

Specialized Supply Chains

- Humanitarian and disaster relief: Trusted relationships help overcome infrastructure failures.
- Hospital: Cost cutting (given quality), actual versus contract prices, tracking and billing accuracy, centralizing supply.
- Retailers: Amazon severely pressuring multichannel distribution model. Stores as DCs.

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SECTION B:
DEMAND ANALYSIS AND PATTERNS

APICS

ASCM

Section B Introduction

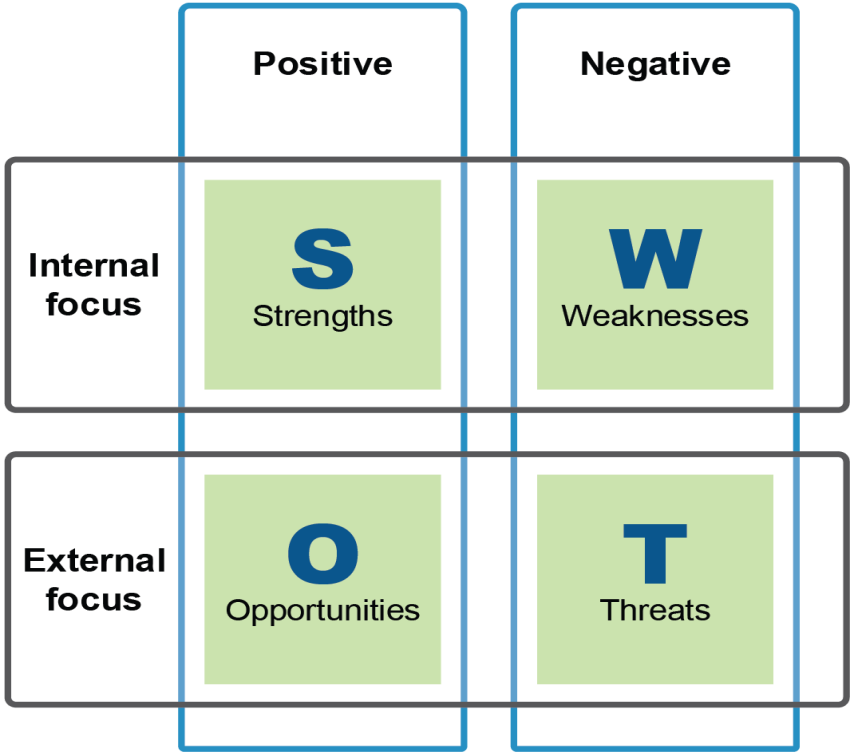
Section B Key Processes:

- Collect and analyze historical and environmental demand data.
  - Perform historical analysis.
    - Competitive environment
  - Perform environmental scan and market analysis.
  - Perform product assessment.
    - Demand patterns

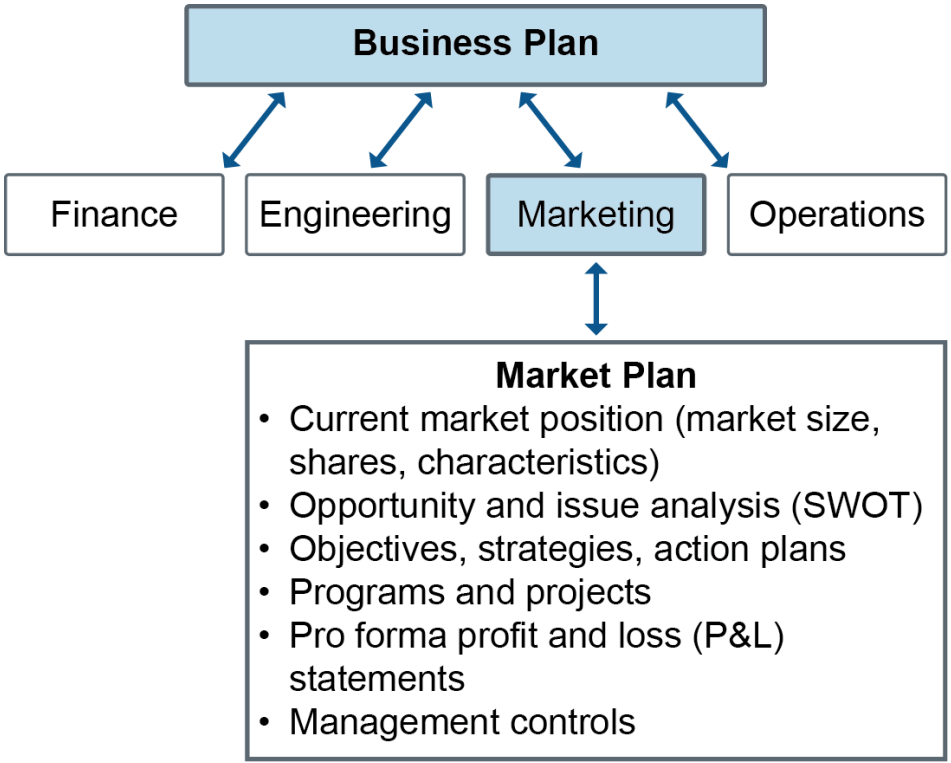
Section B Topics:

- Demand Analysis
- Demand Patterns

SWOT Analysis

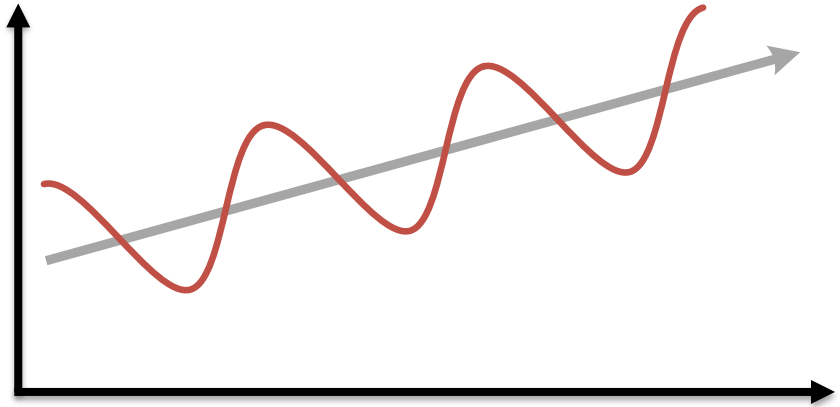


Marketing Strategy and Plan



Market Research: Market Analysis

- Global, local, and industry economy
- Government and third-party sources
- Value deals during recessions



Purposes of Market Research

- Finding potential markets
  - Does anyone care?
- Analyzing markets
  - Who, where, when, why, what, how many?
- Refining product design
  - Strategic price.
  - Include features with positive contribution margin.

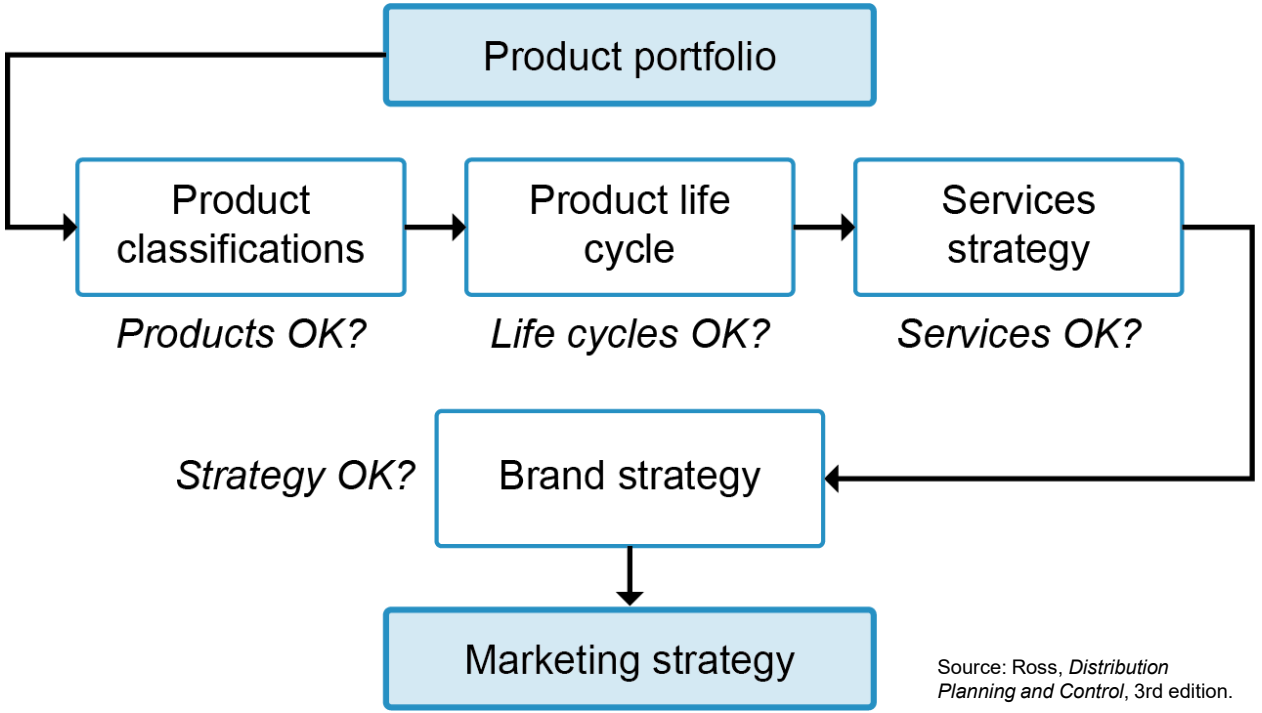
Competition

- Scan
- Regional unsatisfied demand
- Footholds in saturated markets
- Benchmark

Global Perspectives

- Connected
- Complex
- Volatile

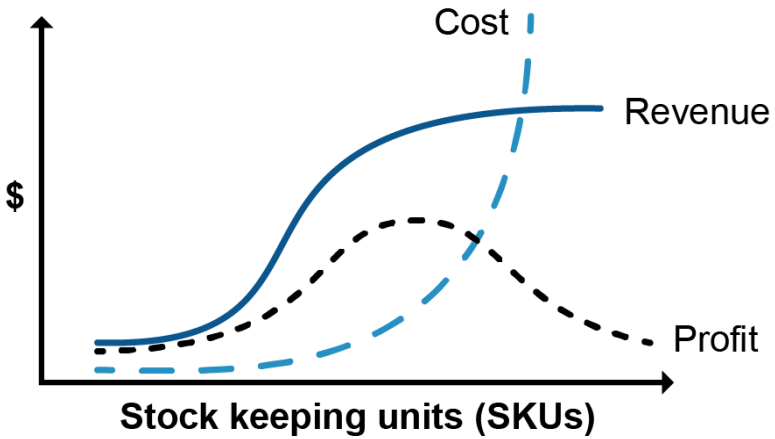
Product Portfolio Management



Source: Ross, *Distribution Planning and Control*, 3rd edition.

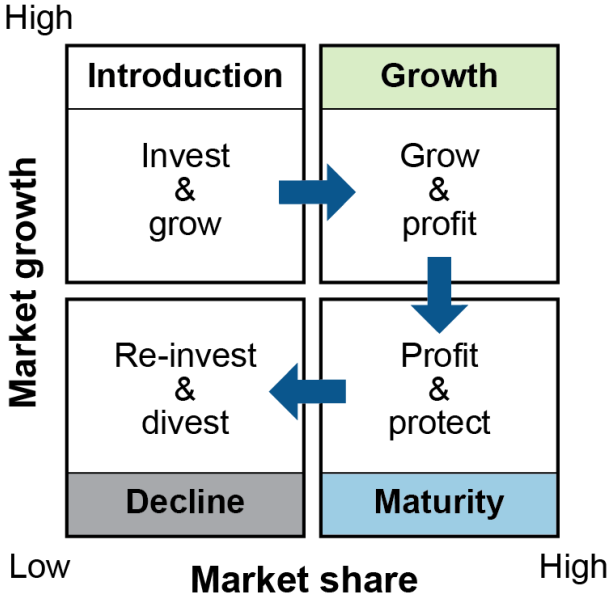
Portfolio Complexity and Life Cycle Reviews

Portfolio Complexity Impact



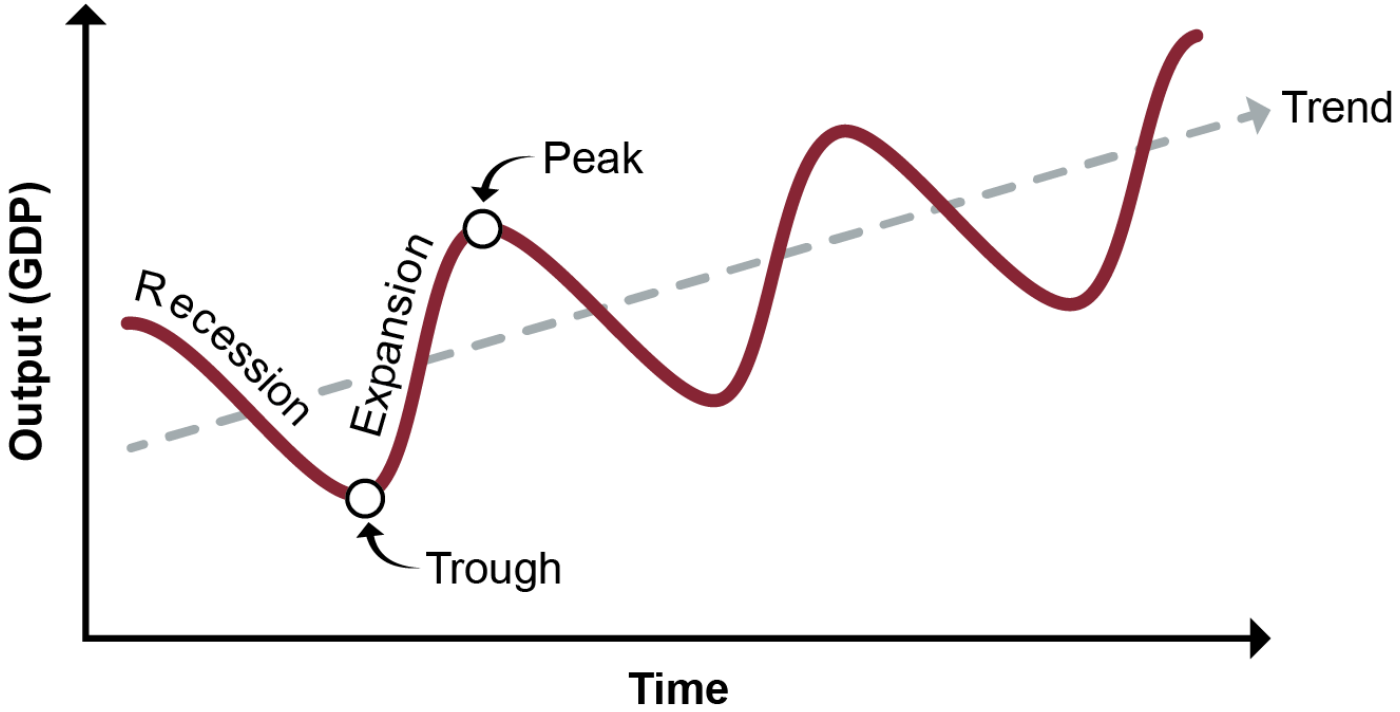
Source: Bowersox, et. al. *Supply Chain Logistics Management*, 5th ed., which cites David Closs, Mark Jacobs, Morgan Swink, and G. Scott Webb, "Toward a Theory of Competencies for the Management of Product Complexity, Six Case Studies." *Journal of Operations Management*,26.

Product Life Cycle Review



Source: Ross, *Distribution Planning and Control*, 3rd edition.

Macroeconomic Demand Patterns

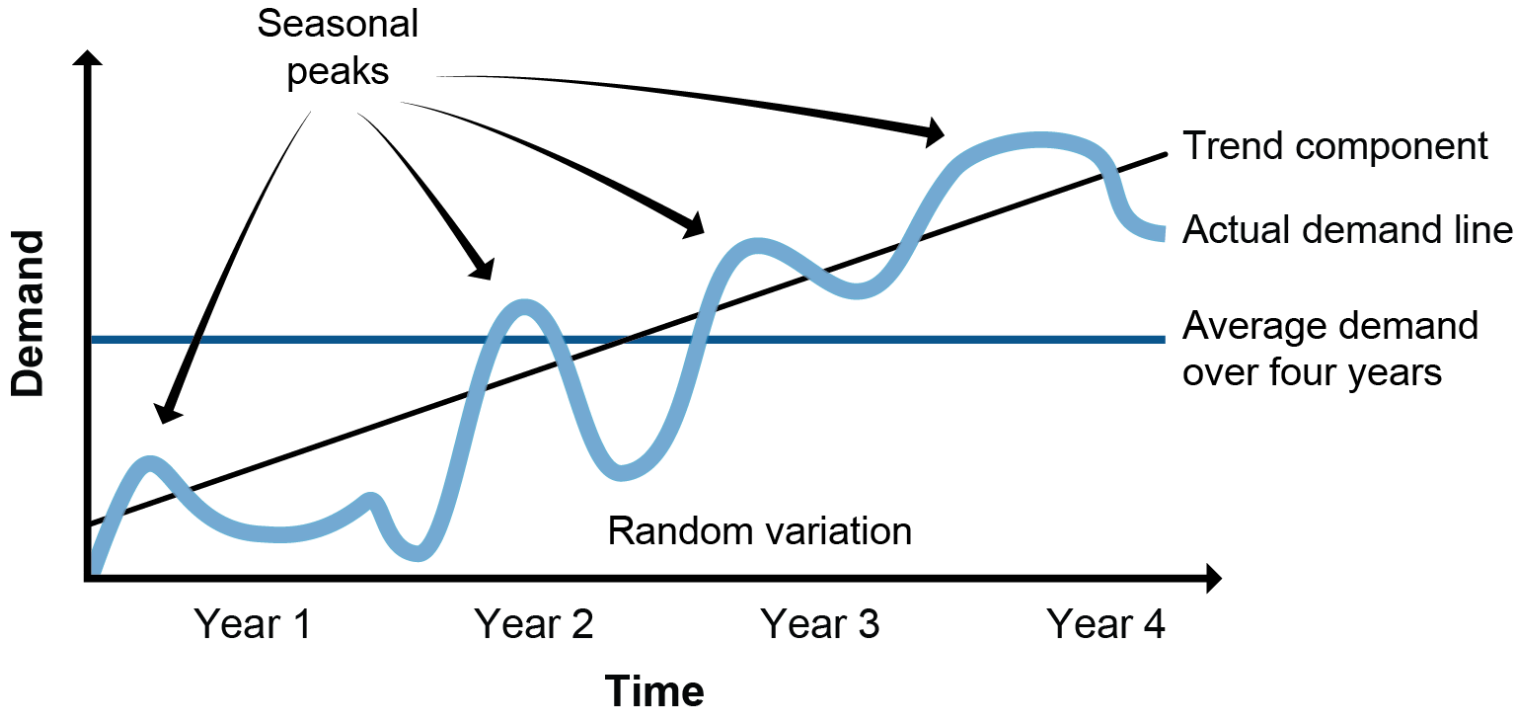


Demand Patterns

Microeconomics

- Price goes up, demand goes down and vice versa.
- Substitution effect: interrelated prices.
- Price adjusts until supply and demand equilibrium.
- Given small price change.
  - Elastic: large change in demand.
  - Inelastic: small change in demand.
  - Maximize profit margin with price changes.
- Marginal analysis: marginal utility > marginal cost.
  - Ignore costs incurred regardless of choice.

Short- to Medium-Term Demand Patterns



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SECTION C:
DEMAND MANAGEMENT

APICS

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Section C Introduction

Section C Key Processes:

- Influence demand through marketing activities.
  - Apply the four Ps.
  - Analyze product life cycles.

Section C Topics:

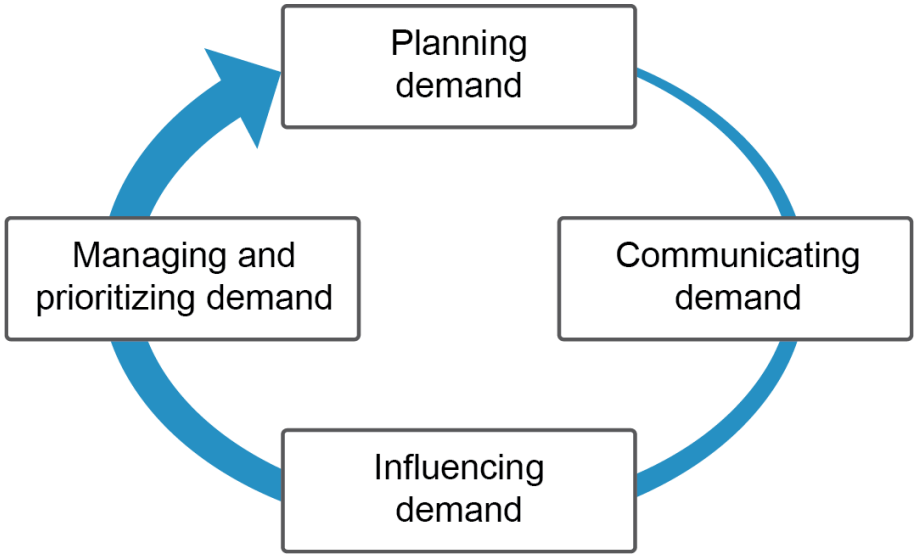
- Demand Management
- Influencing Demand

Demand Management

Demand management is the function of recognizing all demands for goods and services to support the marketplace:

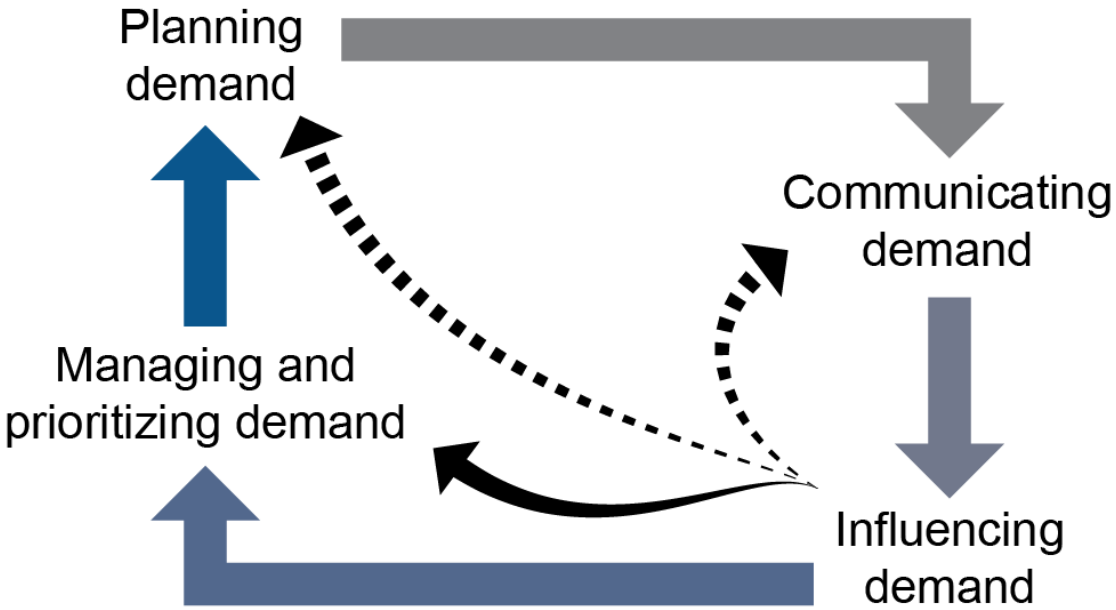
- Prioritizing demand
- Planning, executing, controlling, and monitoring the design, pricing, promotion, and distribution of products and services

Demand Management Road Map



- Liaison
  - Influence to make products market needs.
  - Convince customers to purchase in profitable ways.
- Product-service package order winner capability:
  - Order qualifiers
  - Order winners

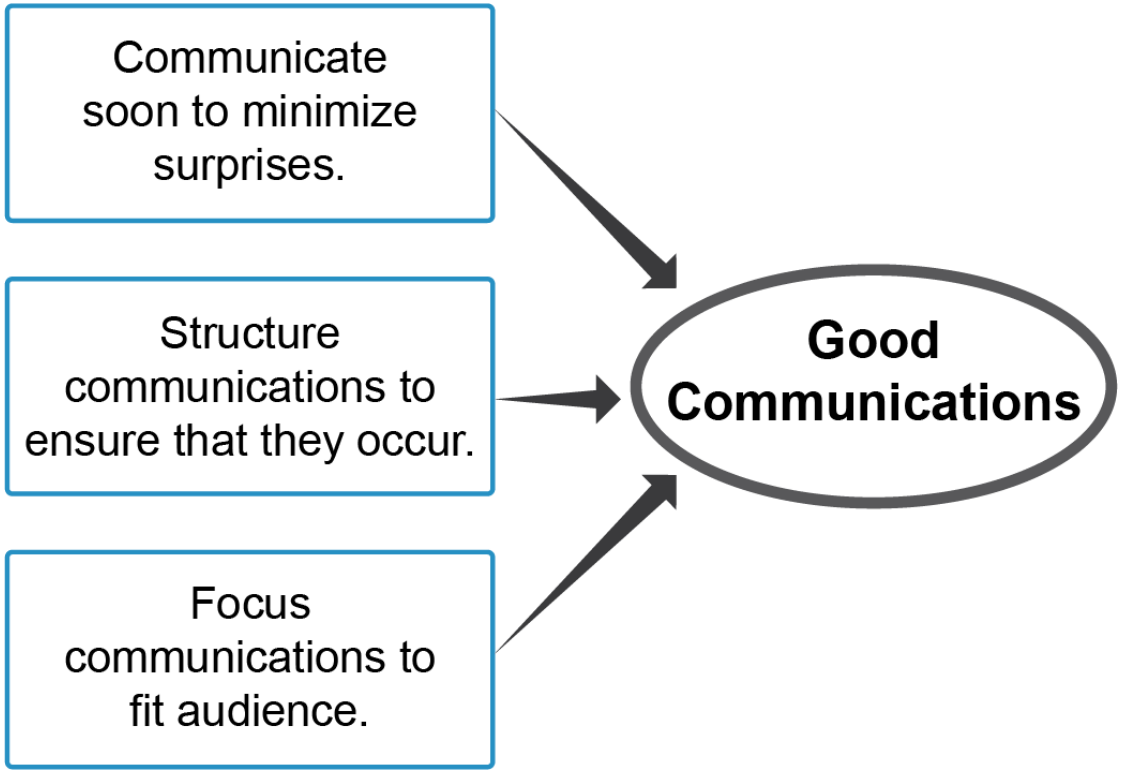
Linkages Among Elements of Demand Management



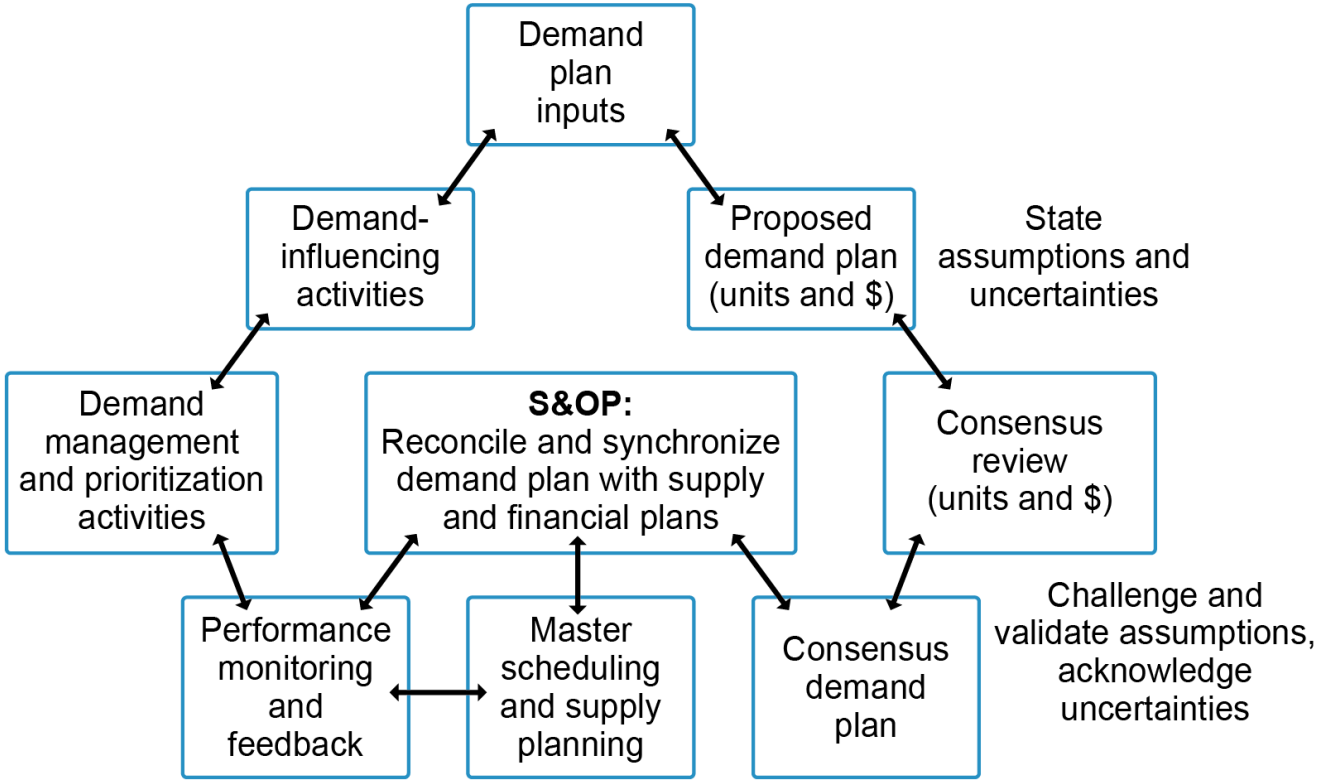
Planning Demand and Demand Plan

- Demand plan is plan for action based on
  - Forecasts
  - Planned demand generation activities.
- Planning horizon
  - Best practice: 18-month+
  - Revise on regular basis

Communicating Demand



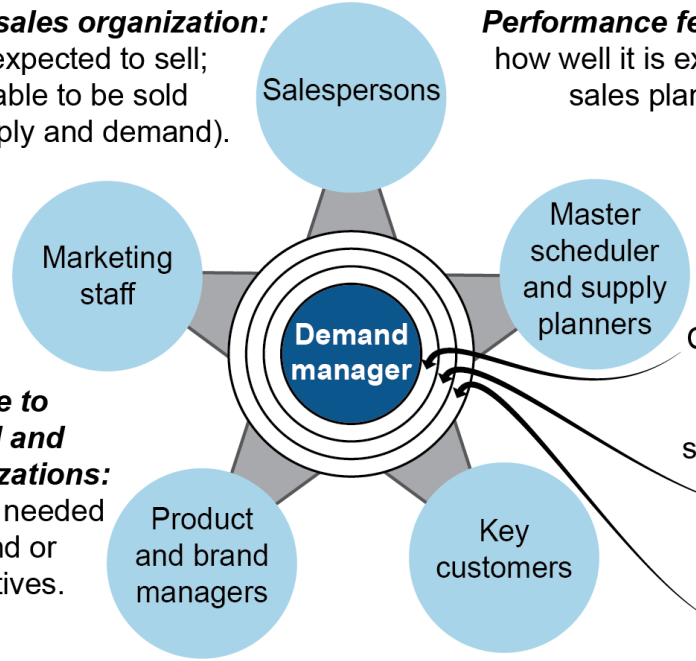
Communications Structure for Communicating Demand



Demand Manager as Focal Point

Communicate to sales organization: what sales is expected to sell; what is available to be sold (consensus supply and demand).

Performance feedback: how well it is executing sales plans.



Communicate to product/brand and marketing organizations: changes in tactics needed to meet demand or business objectives.

Feedback and performance monitoring goals:

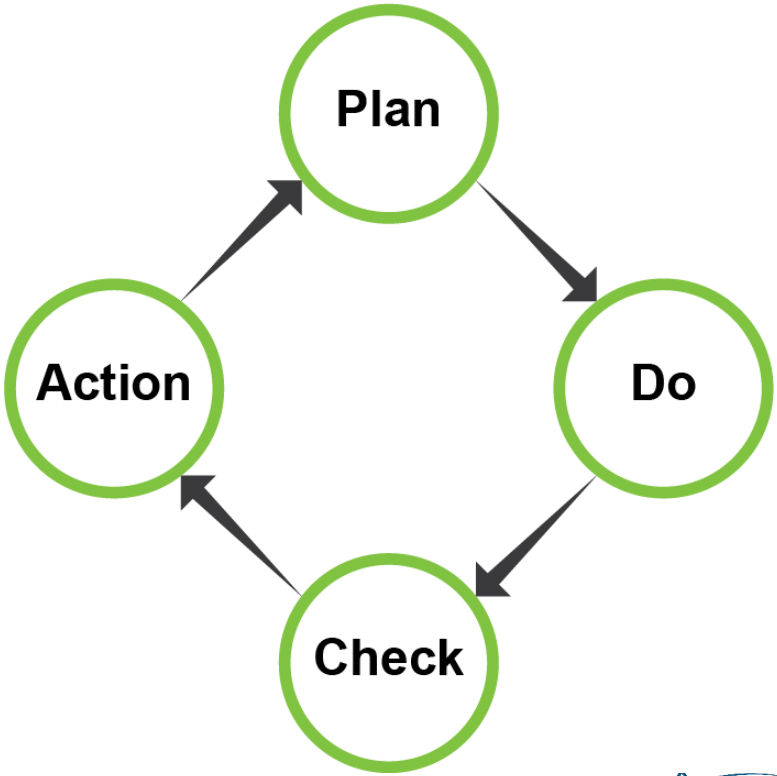
Communicate consensus demand plan and outcome of S&OP processes of reconciling and synchronizing supply and demand.

Get/give feedback on effectiveness of demand management efforts.

Alert product/brand, sales, marketing, and supply organizations of the need for action.

Influencing Demand Using Plan, Do, Check, Action

- Brand, marketing, and sales activities to convince customers to purchase products and services to meet or exceed business objectives
- Influencing product development and supply sides of organization



Demand Generation

- From latent to actual demand
- Educating customers
  - Product/brand awareness takes a long time.
  - Use feedback to modify approach/budget.
- Educating SC partners
  - Persons who design, build transport, or sell product.

4 Ps: Product (Service)

- Was: products identical to all customers; item generated need.
- Is: dynamic; customer need is basis.
- Designed to be customizable for segments.
- Customer care is an implied or explicit product.
- Customized design, manufacture, promotion, distribution, sales methods, and customer care training.

4 Ps: Price

- Strategic decision based on competition, perceived value, and brand identity.
- Commodity price based on competition.
- Differentiated market can base price on R&D, marketing costs, or value to customer.
- Customer-focused differentiates products/price by segment.
- Finds optimal balance of profit vs. attractive price to customers.

4 Ps: Placement

- How to get it to customer.
- Traditionally one-way communication; now back-forth flow.
- Contact channel strategy:
  - Means to increase profitability, control, and consistency
  - Interactive contact channels (call centers, live dialogue websites, chat rooms).
  - Is itself a product; different segments get different options.

Influencing Demand

4 Ps: Promotion: Customer-Focused Promotion Activities

Brand name, logo, image

Loyalty: product → provider.

Trust: Single failure can undo.

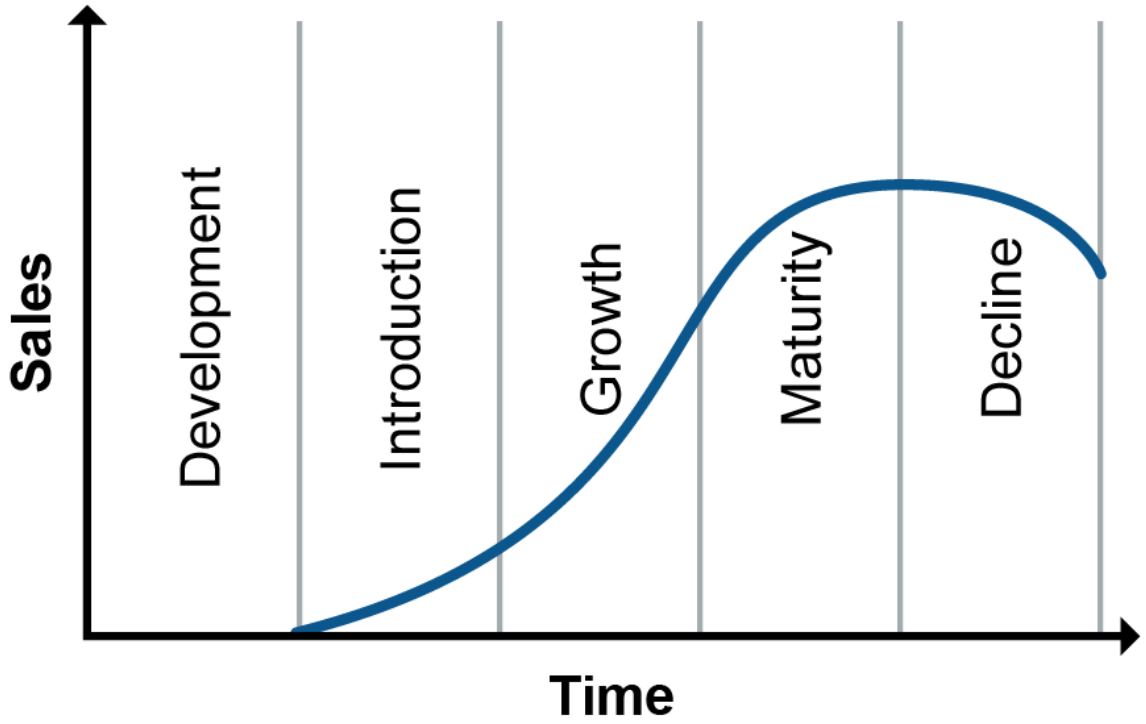
Segmentation of promotions.

Customer focus

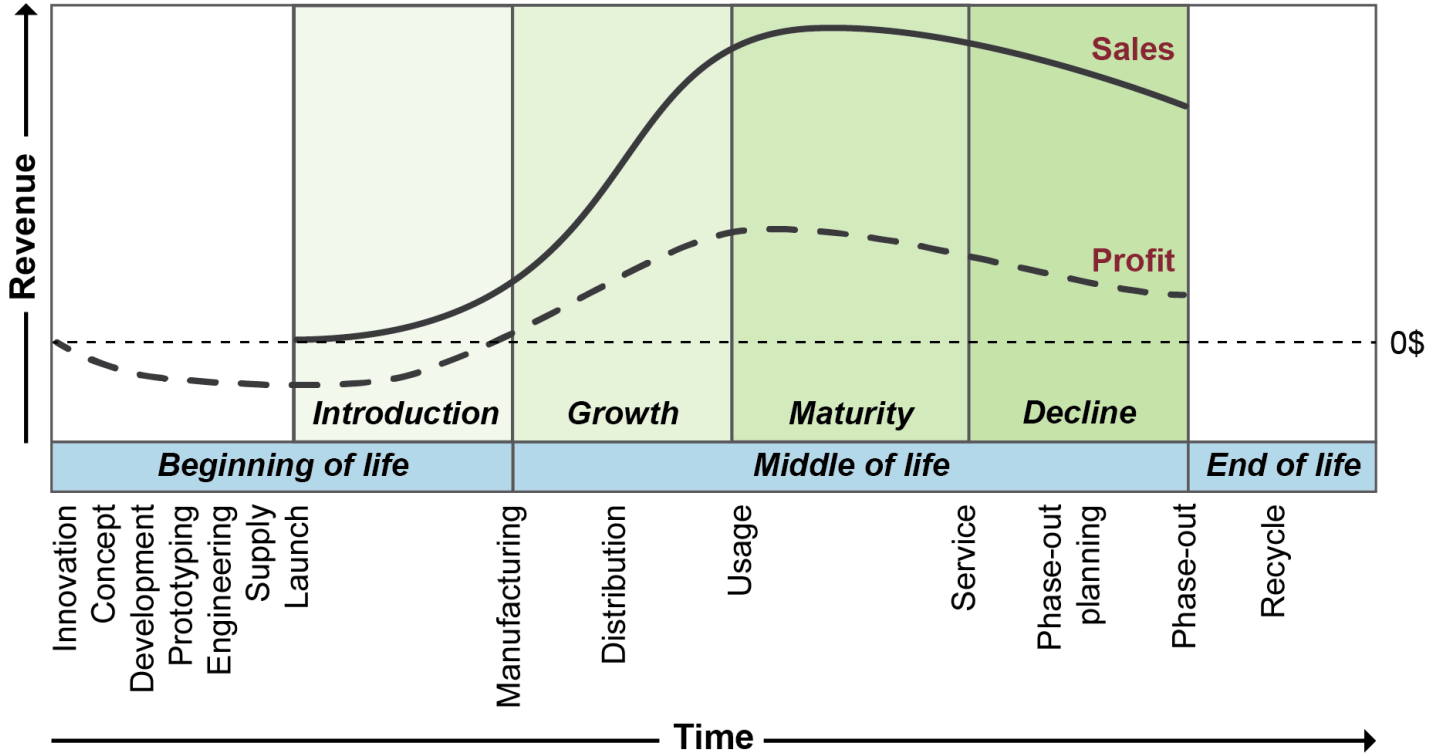
Research and analysis: study buyer motivation and behaviors.

Cost-effective customization of advertising materials.

Product Life Cycle Stages



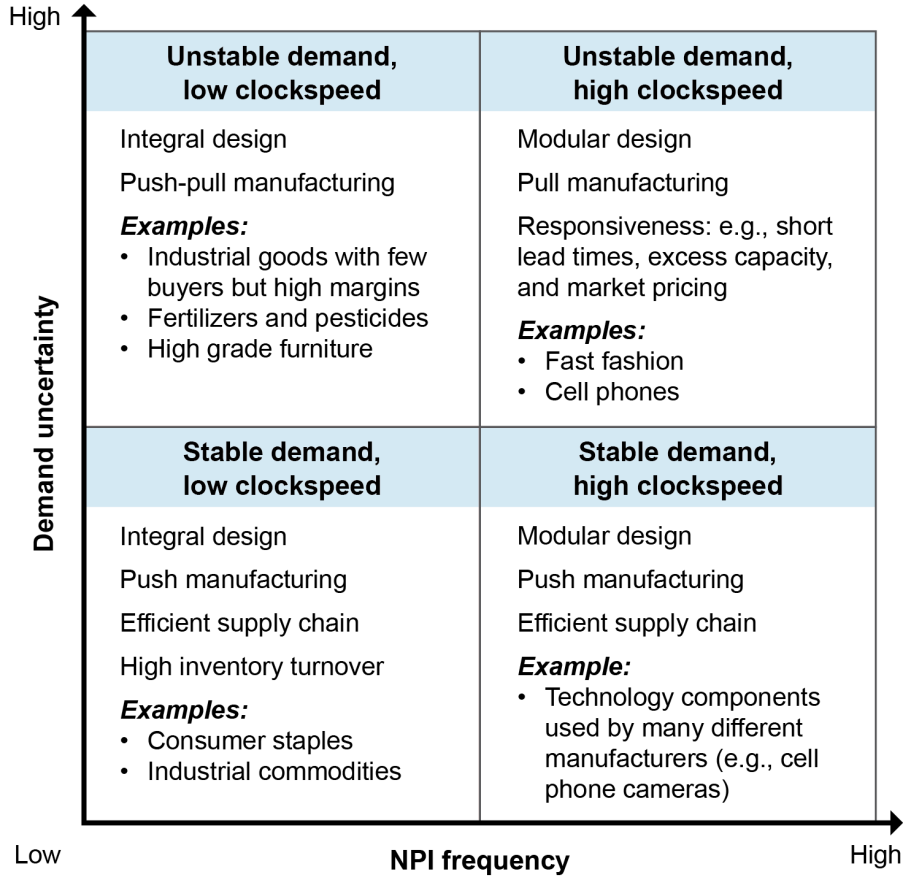
Product Life Cycle Management



Influencing Demand

NPI Frequency versus Demand Uncertainty

- Clockspeed: industry, market, or product rate of technology change



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SECTION D: FORECASTING

APICS

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Section D Introduction

Section D Key Processes:

- Build the forecast.
  - Select appropriate forecasting methods.
    - Qualitative, quantitative
    - Intrinsic, extrinsic
  - Measure forecast accuracy.
    - Forecast error, forecast bias

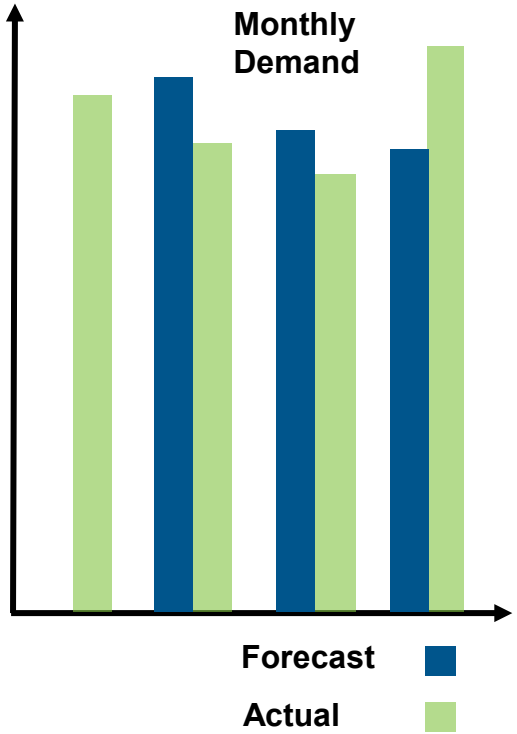
Section D Topics:

- Forecasting Principles and Process
- Forecasting Methods
- Measures of Forecast Error

Principles of Forecasting

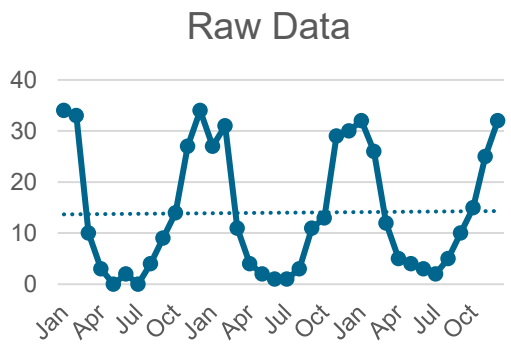
Forecasts are:

- Necessary (sometimes)
- Best based on actual demand rather than just orders
- Wrong (almost always, and they should include an estimate of error)
- More accurate for groups than for single items
- More accurate for near term than for long term.



Forecasting Process

1. Specify purpose,
2. Aggregation, units, and
3. Time horizon.
4. Visualize data.
5. Choose forecasting method or model.



6. Prepare data.
7. Test (historical data).
8. Forecast.
9. Perform S&OP.
10. Review and improve.

Qualitative and Combination Methods

- Estimates
  - $\dfrac{\text{Optimistic} + (4 \times \text{Most Likely}) + \text{Pessimistic}}{6}$
- Judgmental/expert judgment
- Delphi method
  - Anonymous to avoid:
    - "Groupthink"
    - "Stake in the ground"
- Combine with quantitative to add expertise, assumptions
- When to use qualitative forecasting methods:
  - For new products
  - When hard data are lacking

Deseasonalizing

- Calculate month average for each month: e.g., (Jan-Y1 + Jan-Y2 + Jan-Y3)/3
- Calculate year average: Sum month averages and divide by 12.
- Calculate seasonal index:
  - Divide each month average by the year average.
  - Seasonal Index = $\frac{\text{Average Demand for Period (e.g., Month)}}{\text{Average Demand for all Periods (e.g., Year)}}$

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				

Naïve; Simple or Weighted Moving Average

- Naïve: Lasts month's actual is this month's forecast
- Simple moving average:
  - 3−Month Moving Average = $\frac{(M1 + M2 + M3)}{3}$ = $\frac{14.00 + 15.87 + 14.64}{3} = 14.84$
  - Smooths out irregular demand, but lags trend
- Weighted moving average:
  - 3−Month Weighted Moving Average = $\frac{(1 \times M1) + (2 \times M2) + (3 \times M3)}{6}$ = $\frac{(15.51) + (2 \times 19.73) + (3 \times 18.61)}{6} = 18.47$
  - Also smooths, but lags trend less

Exponential Smoothing

- Inputs: last period's forecast, last period's demand, and alpha
  - New Forecast =
    (α ×Last Period's Demand) + [(1 − α) × Last Period's Forecast]
- Alpha, α, a smoothing constant between 0 and 1
  - Example: 0.3, 30% weight on demand, 70% on forecast,
    (0.3 × 14.92) + [(0.7) × 17.71] = 16.87
  - Typically between 0.05 and 0.5
  - Experience, trial and error, and historical testing
- Can minimize lag even more, but not eliminate

Comparison of Time-Series Forecasts

Forecasting month-to-month works well.

	A	C	D	E	I
19		Deseasonalized			
20		Moving Average	Weighted Average	Exponential	Actual Demand
45	Jan	14.45	14.45	**13.43**	14.45
46	Feb	12.13	12.13	**13.74**	12.13
47	Mar	15.27	15.27	**13.26**	15.27
48	Apr	17.50	17.50	**13.86**	17.50
49	May	28.00	28.00	**14.95**	28.00
50	Jun	21.00	21.00	**18.87**	21.00
51	Jul	28.00	28.00	**19.51**	28.00
52	Aug	17.50	17.50	**22.05**	17.50
53	Sep	14.00	14.00	**20.69**	14.00
54	Oct	15.00	15.00	**18.68**	15.00
55	Nov	12.96	12.96	**17.58**	12.96
56	Dec	14.00	14.00	**16.19**	14.00
57	Jan	**13.99**	**13.82**	**15.54**	15.87
58	Feb	**14.28**	**14.76**	**15.64**	14.64
59	Mar	**14.84**	**14.94**	**15.34**	15.68
60	Apr	**15.40**	**15.36**	**15.44**	15.51
61	May	**15.27**	**15.42**	**15.46**	19.73
62	Jun	**16.97**	**17.65**	**16.74**	18.61
63	Jul	**17.95**	**18.47**	**17.30**	17.37
64	Aug	**18.57**	**18.17**	**17.32**	18.61
65	Sep	**18.19**	**18.19**	**17.71**	14.92
66	Oct	**16.97**	**16.56**	**16.87**	15.79
67	Nov	**16.44**	**15.97**	**16.55**	15.51
68	Dec	**15.41**	**15.50**	**16.23**	15.08

	A	C	D
20		Moving Average	Weighted Average
45	Jan	14.45	14.45
46	Feb	12.13	12.13
47	Mar	15.27	15.27
48	Apr	17.50	17.50
49	May	28.00	28.00
50	Jun	21.00	21.00
51	Jul	28.00	28.00
52	Aug	17.50	17.50
53	Sep	14.00	14.00
54	Oct	15.00	15.00
55	Nov	12.96	12.96
56	Dec	14.00	14.00
57	Jan	**13.99**	**13.82**
58	Feb	**13.65**	**13.74**
59	Mar	**13.88**	**13.81**
60	Apr	**13.84**	**13.79**
61	May	**13.79**	**13.79**
62	Jun	**13.84**	**13.79**
63	Jul	**13.82**	**13.79**
64	Aug	**13.82**	**13.79**
65	Sep	**13.82**	**13.79**
66	Oct	**13.82**	**13.79**
67	Nov	**13.82**	**13.79**
68	Dec	**13.82**	**13.79**

Forecasting over longer periods results in same value repeated.

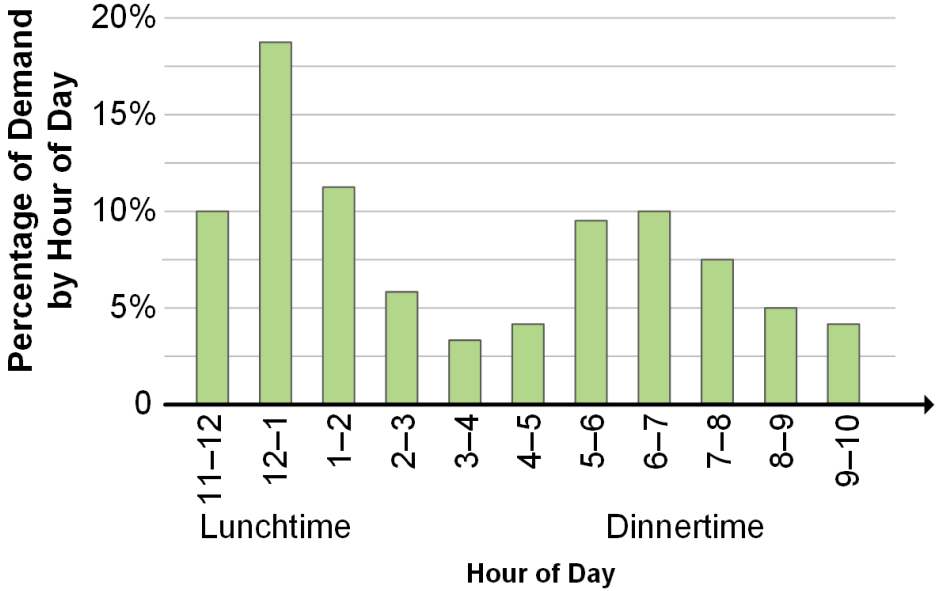
Reseasonalizing

	A	I	O	P	Q	R	S	T	U
1			Deseasonalized			Year 4 Reseasonalized Forecasts			
2	Month	Seasonal Index	Moving Year 4	Weighted Year 4	Expon. Year 4	Moving Average	Weighted Average	Exponential	Year 4 Raw Actuals
3	Jan	2.214	13.99	13.82	15.54	30.97	30.60	34.40	34
4	Feb	2.143	14.28	14.76	15.64	30.60	31.64	33.51	29
5	Mar	0.786	14.84	14.94	15.34	11.66	11.74	12.05	13
6	Apr	0.286	15.40	15.36	15.44	4.40	4.39	4.41	5
7	May	0.143	15.27	15.42	15.46	2.18	2.20	2.21	5
8	Jun	0.143	16.97	17.65	16.74	2.42	2.52	2.39	3
9	Jul	0.071	17.95	18.47	17.30	1.28	1.32	1.24	2
10	Aug	0.286	18.57	18.17	17.32	5.31	5.19	4.95	6
11	Sep	0.714	18.19	18.19	17.71	13.00	13.00	12.65	11
12	Oct	1.000	16.97	16.56	16.87	16.97	16.56	16.87	16
13	Nov	1.929	16.44	15.97	16.55	31.71	30.80	31.91	30
14	Dec	2.286	15.41	15.50	16.23	35.21	35.44	37.11	33

$0.786 \times 14.84 = 11.66$ $0.071 \times 18.47 = 1.32$

Service-Sector Forecasting

- Service sector may track "seasonal" demand in units as short as minutes.
- Restaurant variables
  - Workers per shift
  - Registers in operation
  - Number of available tables
  - Space requirements
  - Amount and types of foods



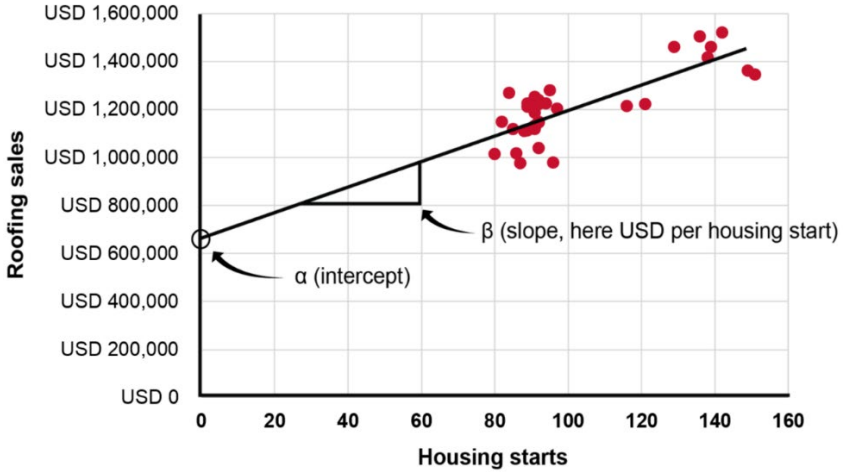
Leading and Lagging Economic Indicators

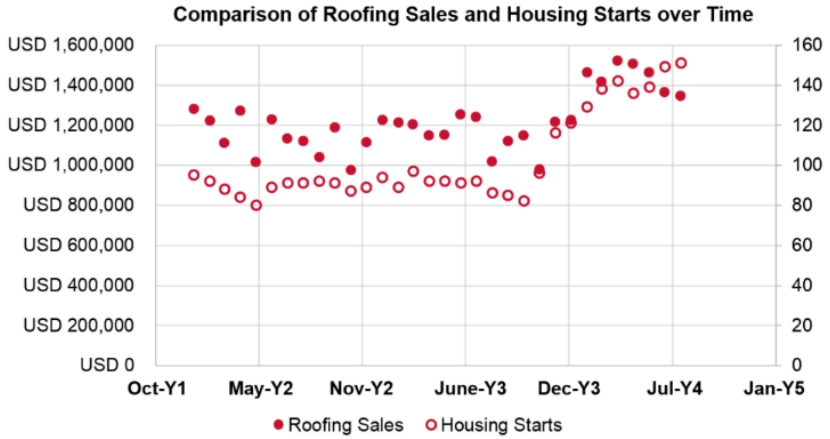
Lagging Indicators	Leading Indicators
▪ Unemployment rate	▪ Building permits
▪ Outstanding loans	▪ Initial unemployment claims
▪ Inventory to sales	▪ Orders for plant equipment, durable goods and materials
▪ Changes in company profits	▪ Changes in money supply
▪ Spending by businesses	▪ S&P 500
▪ Consumer price index (CPI)	▪ Long- vs. short-term rates
▪ Average duration of unemployment	▪ Consumer optimism

Past and current trends → **Future trends**

Associative Forecasting

- $y = \alpha + \beta x$
- Roofing Sales = α + (β ×Prior Month's Housing Starts)





Forecast Error

$$\text{Forecast Error} = |A - F|$$
$$= |29 \text{ units} - 33.51 \text{ units}| = |-4.51 \text{ units}| = 4.51 \text{ units}$$

- *Where:*
  - A = Actual demand
  - F = Forecast demand
  - Absolute = | |
- NOTE: An absolute value has no +/– sign, and so, in this case, it measures the size of the error, not the direction.

Forecast Error and Accuracy

- Forecast Error as a Percentage = $\frac{|A - F|}{A} = \frac{|29 \text{ units} - 33.51 \text{ units}|}{29 \text{ units}} = \frac{4.51 \text{ units}}{29 \text{ units}} = 0.155 =$ 15.5% error
- Forecast Accuracy = 1 − Forecast Error as a Percentage = 1 − 0.155 = 0.845 = 84.5% accuracy
- ***Where:***
  - A = Actual demand
  - F = Forecast demand

Bias and Random Variation

Bias

- Consistent deviation from the mean in one direction
- Good forecast: not biased
- Cumulative Forecast Error = Cumulative Actual Demand − Cumulative Forecast Demand
- Not absolute (direction matters)

Random Variation

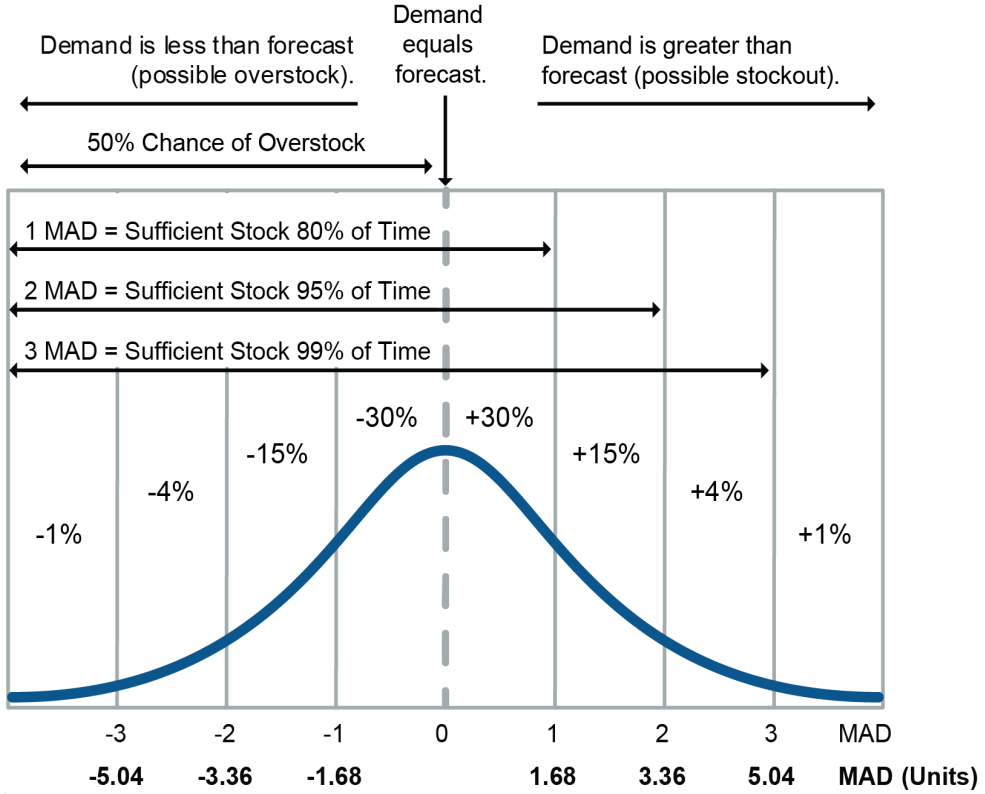
- If cumulative actual demand = cumulative forecast demand, then no bias.
- Wide swings in both directions can still cause issues.

Mean Absolute Deviation (MAD) with Smoothing

	R	S	T	U	V	W	X
1	Year 4 Reseasonalized Forecasts				Absolute Errors		
2	Moving Average	Weighted Average	Exponential	Year 4 Raw Actuals	Moving Error	Weighted Error	Expon. Error
3	30.97	30.60	34.40	34	3.03	3.40	0.40
4	30.60	31.64	33.51	29	1.60	2.64	4.51
5	11.66	11.74	12.05	13	1.34	1.26	0.95
6	4.40	4.39	4.41	5	0.60	0.61	0.59
7	2.18	2.20	2.21	5	2.82	2.80	2.79
8	2.42	2.52	2.39	3	0.58	0.48	0.61
9	1.28	1.32	1.24	2	0.72	0.68	0.76
10	5.31	5.19	4.95	6	0.69	0.81	1.05
11	13.00	13.00	12.65	11	2.00	2.00	1.65
12	16.97	16.56	16.87	16	0.97	0.56	0.87
13	31.71	30.80	31.91	30	1.71	0.80	1.91
14	35.21	35.44	37.11	33	2.21	2.44	4.11
15				SUM	18.25	18.45	20.20
16				MAD	1.52	1.54	1.68

- MAD = $\frac{\Sigma|A - F|}{n} = \frac{20.2}{12}$ = 1.68 units
- Note: the Greek uppercase letter ∑ stands for “the sum of.”

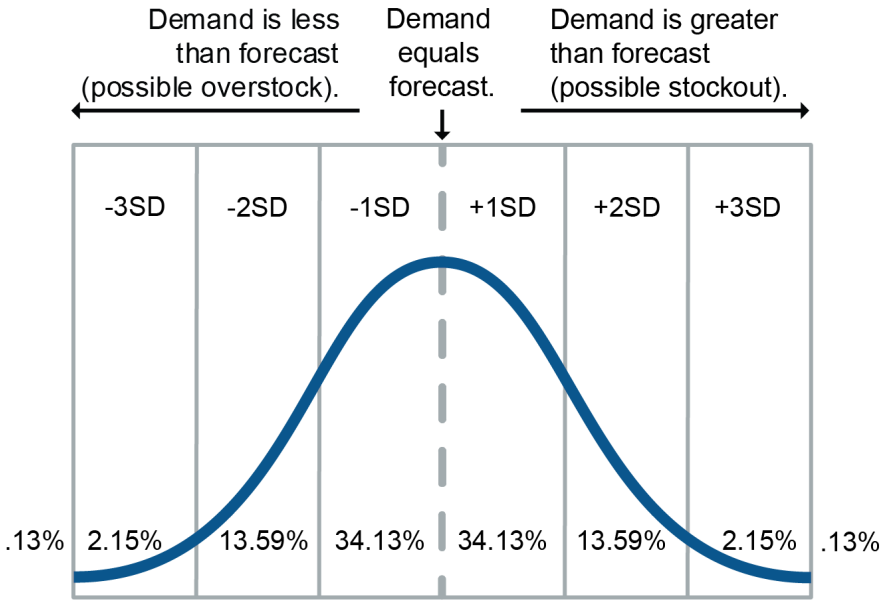
Distribution Curve for MAD of 1.68 Units



Standard Deviation

- Difference between average and actual observations, squared, divided by *n* (or *n*−1), then square root.
- Standard Deviation

$$= \sqrt{\frac{\Sigma(\text{Sample} - \text{Sample Mean})^2}{n - 1}}$$



Other Measures of Forecast Error

- Tracking Signal = $\frac{\text{Algebraic Sum of Forecast Errors}}{\text{Mean Absolute Deviation}} = \frac{-6.69}{1.68} = -3.98$
- MSE = $\frac{\Sigma(\text{Errors for Each Period})^2}{\text{Number of Forecast Periods}} = \frac{55.57}{12} = 4.63$
- MAPE = $\frac{\Sigma\left(\frac{|A-F|}{A}\right)}{n} = \frac{206.87\%}{12} = 17.24\%$

Measures of Forecast Error

MAD, Tracking Signal, and MSE

	U	V	W	X	AD	AE	AF	AG	AH	AI
1		Absolute Errors								
2	Year 4 Raw Actuals	Moving Error	Weighted Error	Expon. Error	Moving Error +/-	Weighted Error +/-	Expon. Error +/-	Squared Moving Error	Squared Weighted Error	Squared Expon. Error
3	34	3.03	3.40	0.40	3.03	3.40	-0.40	9.16	11.54	0.16
4	29	1.60	2.64	4.51	-1.60	-2.64	-4.51	2.55	6.95	20.31
5	13	1.34	1.26	0.95	1.34	1.26	0.95	1.80	1.58	0.90
6	5	0.60	0.61	0.59	0.60	0.61	0.59	0.36	0.37	0.35
7	5	2.82	2.80	2.79	2.82	2.80	2.79	7.94	7.82	7.79
8	3	0.58	0.48	0.61	0.58	0.48	0.61	0.33	0.23	0.37
9	2	0.72	0.68	0.76	0.72	0.68	0.76	0.52	0.46	0.58
10	6	0.69	0.81	1.05	0.69	0.81	1.05	0.48	0.65	1.10
11	11	2.00	2.00	1.65	-2.00	-2.00	-1.65	3.98	3.98	2.72
12	16	0.97	0.56	0.87	-0.97	-0.56	-0.87	0.93	0.31	0.76
13	30	1.71	0.80	1.91	-1.71	-0.80	-1.91	2.91	0.64	3.66
14	33	2.21	2.44	4.11	-2.21	-2.44	-4.11	4.90	5.93	16.87
15	SUM	18.25	18.45	20.20	1.30	1.60	-6.69	35.87	40.47	55.57
16	MAD	1.52	1.54	1.68						
17	MSE	2.99	3.37	4.63						
19	Tracking Signal	0.85	1.04	-3.98						

Measures of Forecast Error

MAPE

	R	S	T	U	V	W	X	Y	Z	AA
1	Year 4 Reseasonalized Forecasts				Absolute Errors					
2	Moving Average	Weighted Average	Exponential	Year 4 Raw Actuals	Moving Error	Weighted Error	Expon. Error	Moving APE	Weighted APE	Expon. APE
3	30.97	30.60	34.40	34	3.03	3.40	0.40	8.9%	10.0%	1.2%
4	30.60	31.64	33.51	29	1.60	2.64	4.51	5.5%	9.1%	15.5%
5	11.66	11.74	12.05	13	1.34	1.26	0.95	10.3%	9.7%	7.3%
6	4.40	4.39	4.41	5	0.60	0.61	0.59	12.0%	12.2%	11.8%
7	2.18	2.20	2.21	5	2.82	2.80	2.79	56.4%	55.9%	55.8%
8	2.42	2.52	2.39	3	0.58	0.48	0.61	19.2%	16.0%	20.3%
9	1.28	1.32	1.24	2	0.72	0.68	0.76	35.9%	34.0%	38.2%
10	5.31	5.19	4.95	6	0.69	0.81	1.05	11.6%	13.5%	17.5%
11	13.00	13.00	12.65	11	2.00	2.00	1.65	18.1%	18.1%	15.0%
12	16.97	16.56	16.87	16	0.97	0.56	0.87	6.0%	3.5%	5.5%
13	31.71	30.80	31.91	30	1.71	0.80	1.91	5.7%	2.7%	6.4%
14	35.21	35.44	37.11	33	2.21	2.44	4.11	6.7%	7.4%	12.4%
15				SUM	18.25	18.45	20.20	196.3%	192.0%	206.9%
16				MAD	1.52	1.54	1.68			
18				MAPE	16.4%	16.0%	17.2%			

CSCP CERTIFIED SUPPLY CHAIN PROFESSIONAL

SECTION E:
SUPPLY AND DEMAND ALIGNMENT

APICS

ascm

Section E Introduction

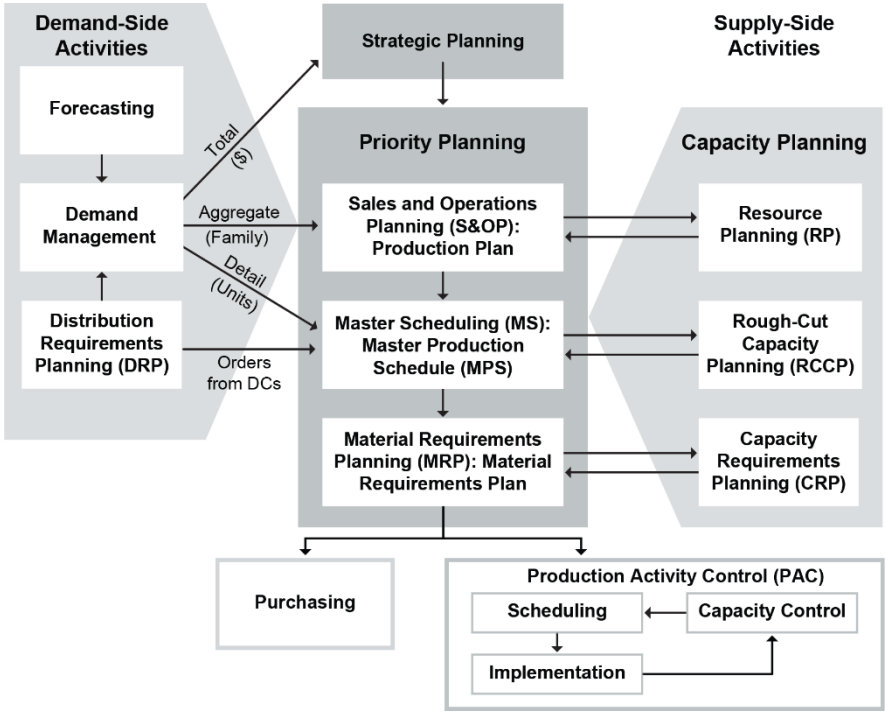
Section E Key Processes:

- Align supply with demand.
  - Execute sales and operations planning (S&OP) process.
  - Manage inputs and outputs.
  - Perform reconciliation and analysis.

Section E Topics:

- Supply and Demand Alignment
- Sales and Operations Planning

Operations Planning and Control



Strategic and Business Planning

- Strategic plan
  - Mission and the resources needed to get there
  - Goals: Market share, revenue, profits, and growth
  - Objectives: Value to customers, owners
- Business plan
  - Inputs: demand plan and long-term forecasts
  - Explicit vision to achieve strategy over 1-3 years
  - In dollars and grouped by product family
  - Point of reference for S&OP
  - Guidance for tactical production and sales plans

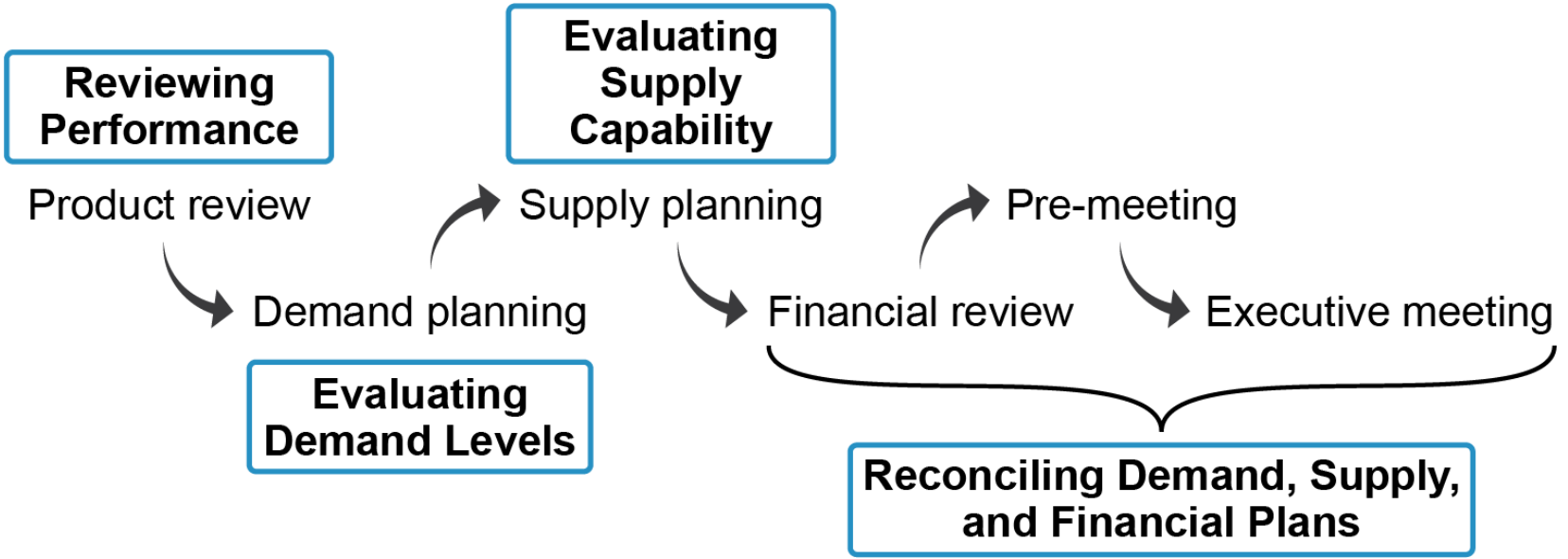
Master Planning and Resource Planning

Master Planning	Resource Planning
▪ Long-term resource plan ▪ Near-medium-term sales and operations plan ▪ Available capacity (S&OP) plus investments in capacity (resource planning) ▪ Satisfy stakeholders including ROI	▪ 15- to 18-month capacity planning ▪ Capacity at business and production plan level ▪ Resources that take long to acquire ▪ Lead time to get equipment, install it, and get it producing

Monthly Sales and Operations Planning Process

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

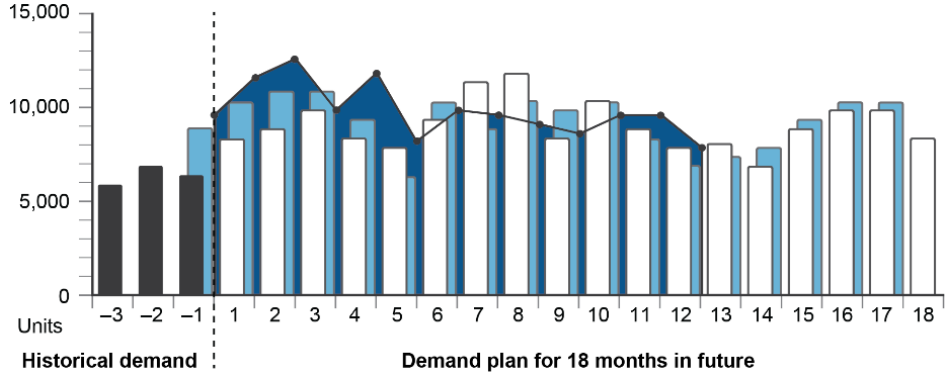
Sales and Operations Planning (S&OP)



Demand Planning Phase Meeting

- Highest-ranking demand-side professional chairs.
- Dashboards
  - Consolidate product, brand, marketing, sales plans.
  - Demand plan: units and $.
  - Metrics, assumptions, events, opportunities, risks, and decisions.
- Meeting brevity:
  - Product family, rest by exception.
  - What changed since last meeting (replanning).
  - Validating assumptions.
- Strategies to close demand and business plan gaps.
- Success: communications.

Demand Plan Dashboard in 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.

Evaluating Supply Capability

Supply/Demand Match

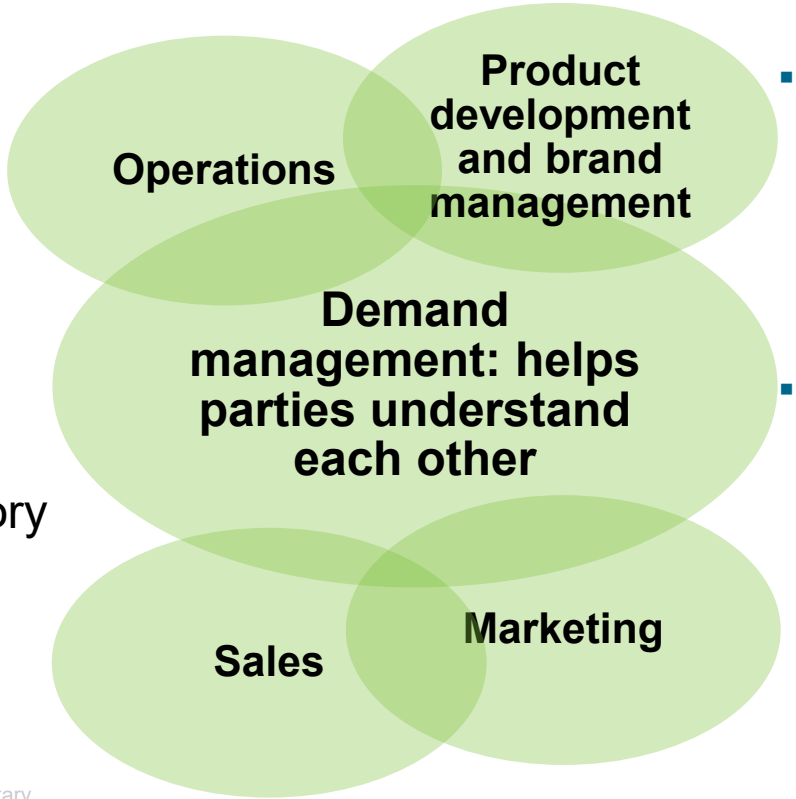
- Production plan will match demand plan.

Supply/Demand Mismatch

- Supply develops alternative plans:
  - Produce above demand for certain periods to meet later spikes in demand.
  - Increase capacity by hiring, adding shift, planning overtime, leasing equipment, or outsourcing (or opposite).
  - Reducing demand plan (as last resort).

S&OP Inputs and Outputs

- Operations
  - Represent demand-side interests in operations terms
- Sales
  - Daily
  - Sufficient inventory
  - Time to market



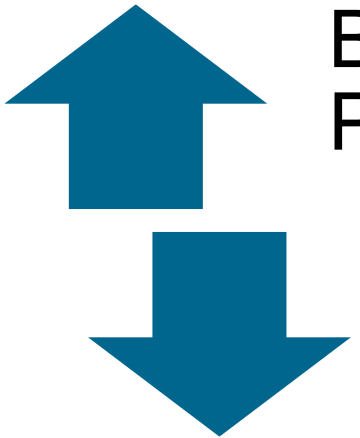
- Product development and brand management
  - Long-term
  - Seek value added
- Marketing
  - Medium to short term
  - Tailoring demand to capacity

Reconciliation: Executive Meeting

- Participants: CEO and demand, supply, and financial executives and other direct reports to CEO.
- Goal: consensus demand plan.
  - Review metrics, changes, new risks and opportunities, and other events.
- Executives will want to know:
  - Are plans on budget, schedule, and scope?
  - How are product mixes performing?
  - Do strategies need modifying and when do decisions need to be made?
- Communication of agreed-upon plan to all internal participants is critical.
  - Depends on quality of internal communications process.

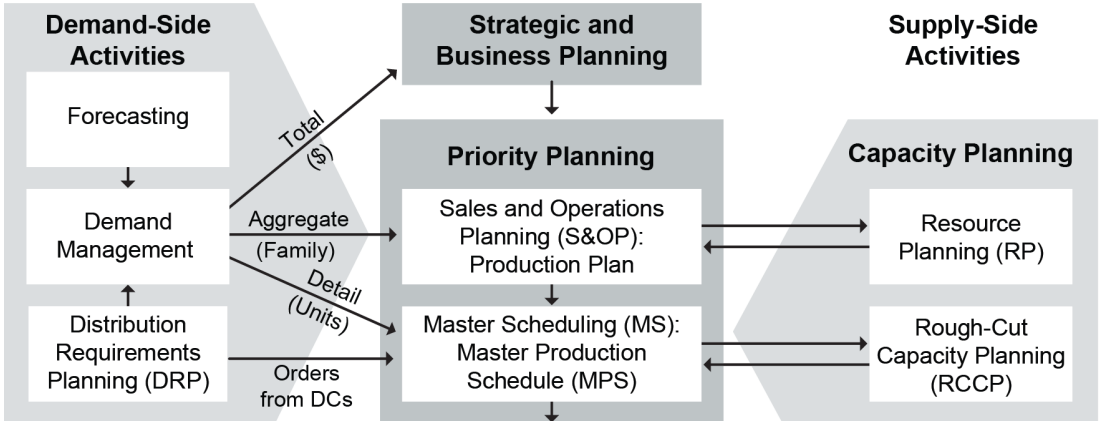
Implementing S&OP: Coordinating Function

- S&OP institutionalizes functional area communications.
- Assembles all facts for debate and reconciles functional plans.
- Links business planning and tactics (short to medium term) to enable proactive responses.
- Builds bridge from customer value to SC efficiency.
- Replanning motivates continuous improvement.



Business Planning

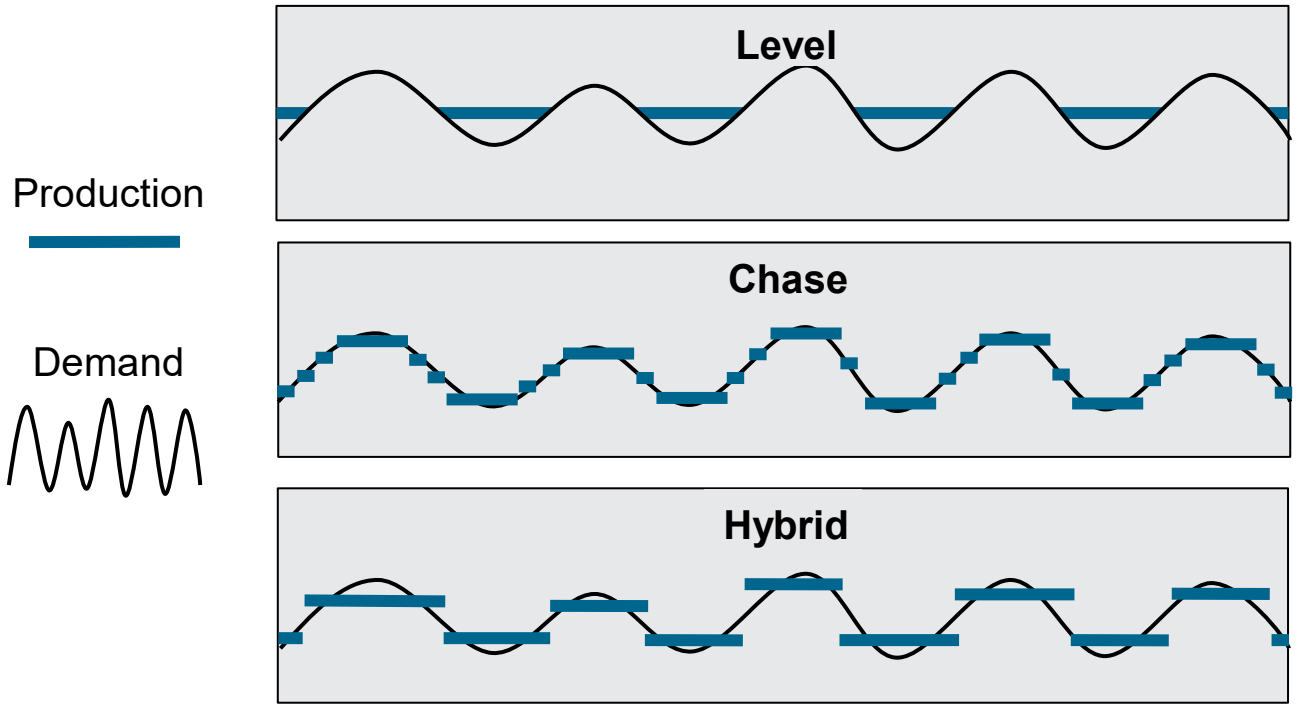
Tactics



Contributions to S&OP: Cooperation Among…

Demand Side	Finance	Supply Side
▪ Demand forecasts ▪ Demand plan commitments ▪ Demand plan numbers and assumptions ▪ Market analysis	▪ Financial feasibility ▪ Fit with business plan	▪ Output and resources ▪ Product families ▪ Operations constraints ▪ Operations strategies ▪ Supply-demand strategies ▪ Actual results and other performance metric data

Operations Strategies



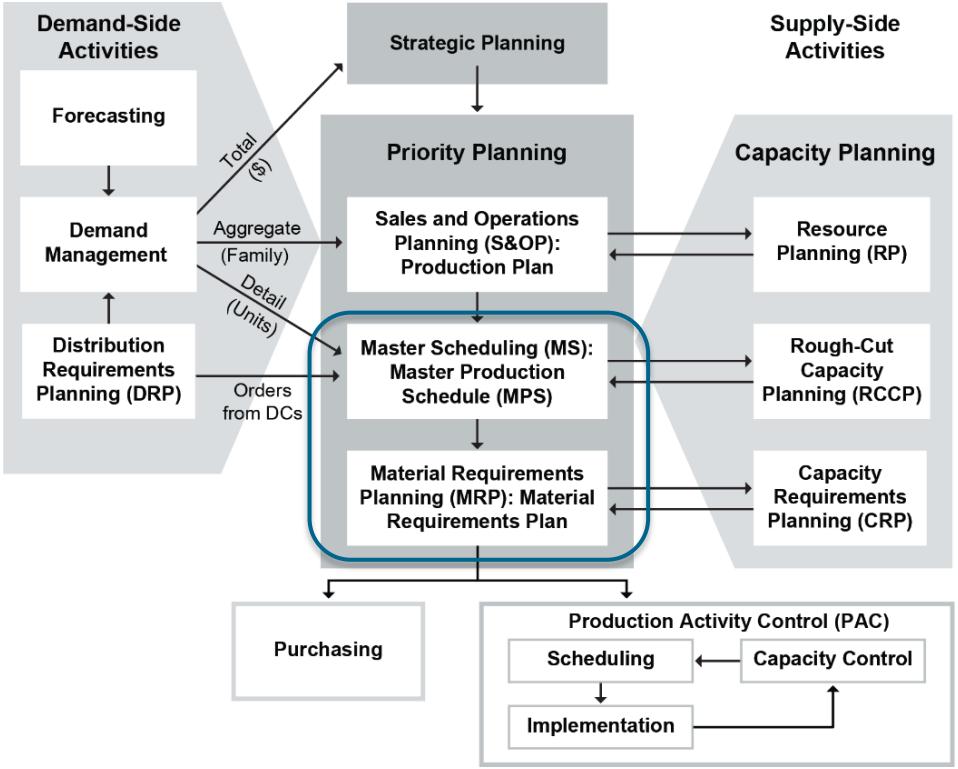
Supply-Demand Strategies

Allocation:

- Assign items to specific orders but still in inventory
- Process to distribute materials in short supply

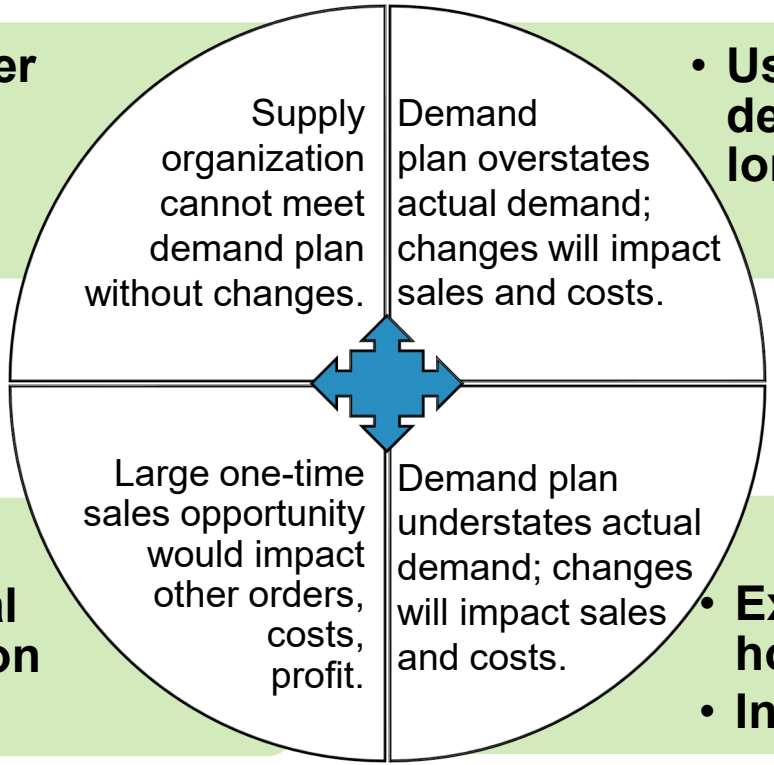
Supply-Demand Option	MPS Focus
Make-to-stock (MTS) • Few items made from many components • Integral design	Schedule finished goods.
Make-to-order (MTO) • Many items made from few components • Custom	Schedule raw materials.
Assemble-to-order (ATO) • Many end items, few components • Assemble near point-of-sale	Schedule module production.

Demand Management and Prioritization: MPS and MRP



Situations for Managing and Prioritizing Demand

- **Find ways to better use current capacity.**



- **Use time fences to delay production as long as feasible.**
- **Establish unusual demand evaluation process.**
- **Extend planning horizon.**
- **Incentivize substitutes.**

Measures of Customer Service Levels

- Is cost of achieving a given service level a sound investment?
- Fill rates:
  - Unit fill rate
  - Line-item fill rate
  - Monetary value fill rate
- Stockout frequency
- Lead time monitoring
  - Speed of performance
  - Consistency
  - Flexibility
  - Malfunction recovery
- Order status reporting
- Customer satisfaction
  - Establish, then fulfill expectations