

CSCP

CERTIFIED SUPPLY CHAIN
PROFESSIONAL

MODULE 1: SUPPLY CHAINS, DEMAND MANAGEMENT, AND FORECASTING

SECTION A: INTRODUCTION TO SUPPLY CHAINS

Section A Introduction

Section A Key Processes:

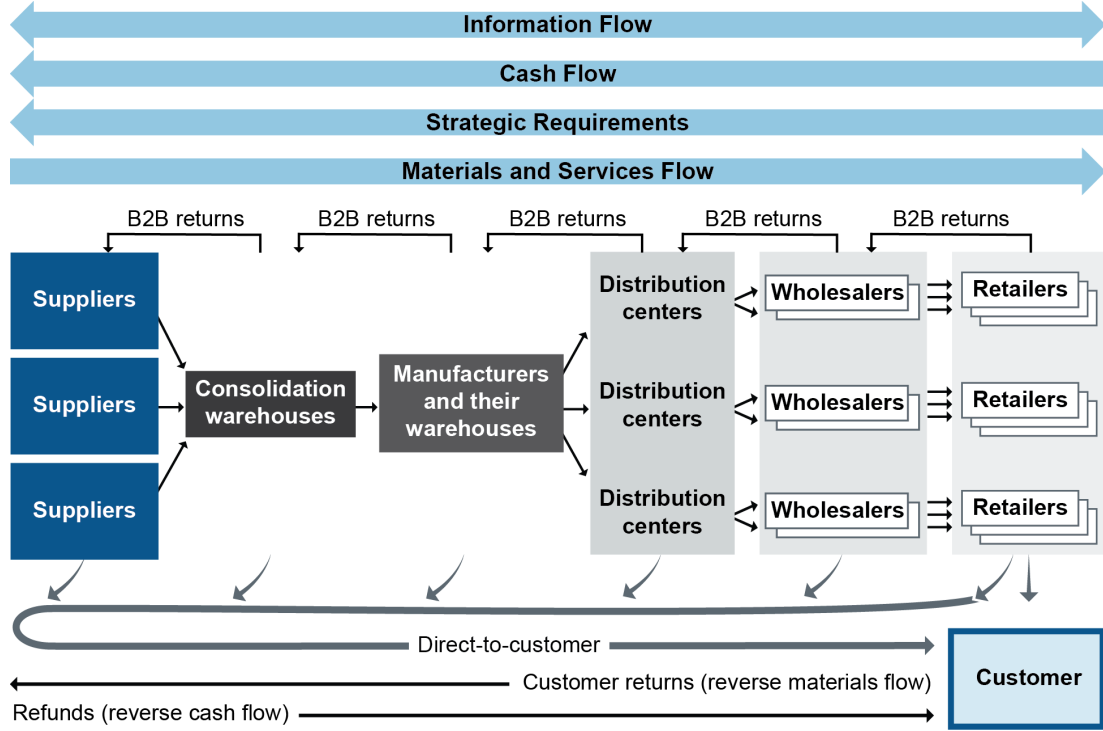
- Design the supply chain network.
 - Flow of product, information, and funds

Section A Topics:

- Supply Chain Models
- Supply Chain Maturity and Complexity

Supply Chain Models

Basic Supply Chain for a Product

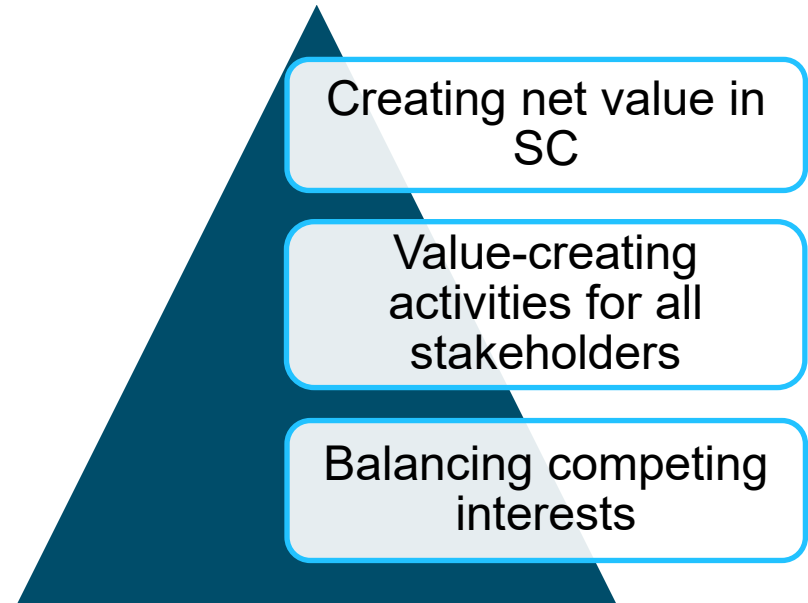


Funds Flows, Value, and Balance

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.

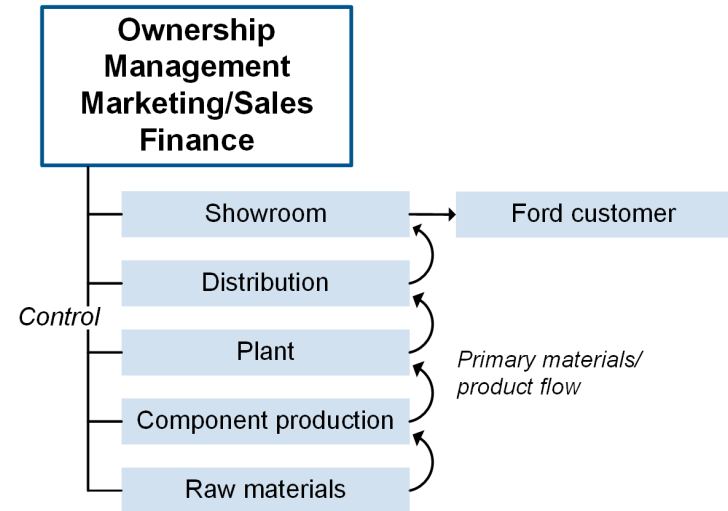
Value and Balance



Supply Chain Models

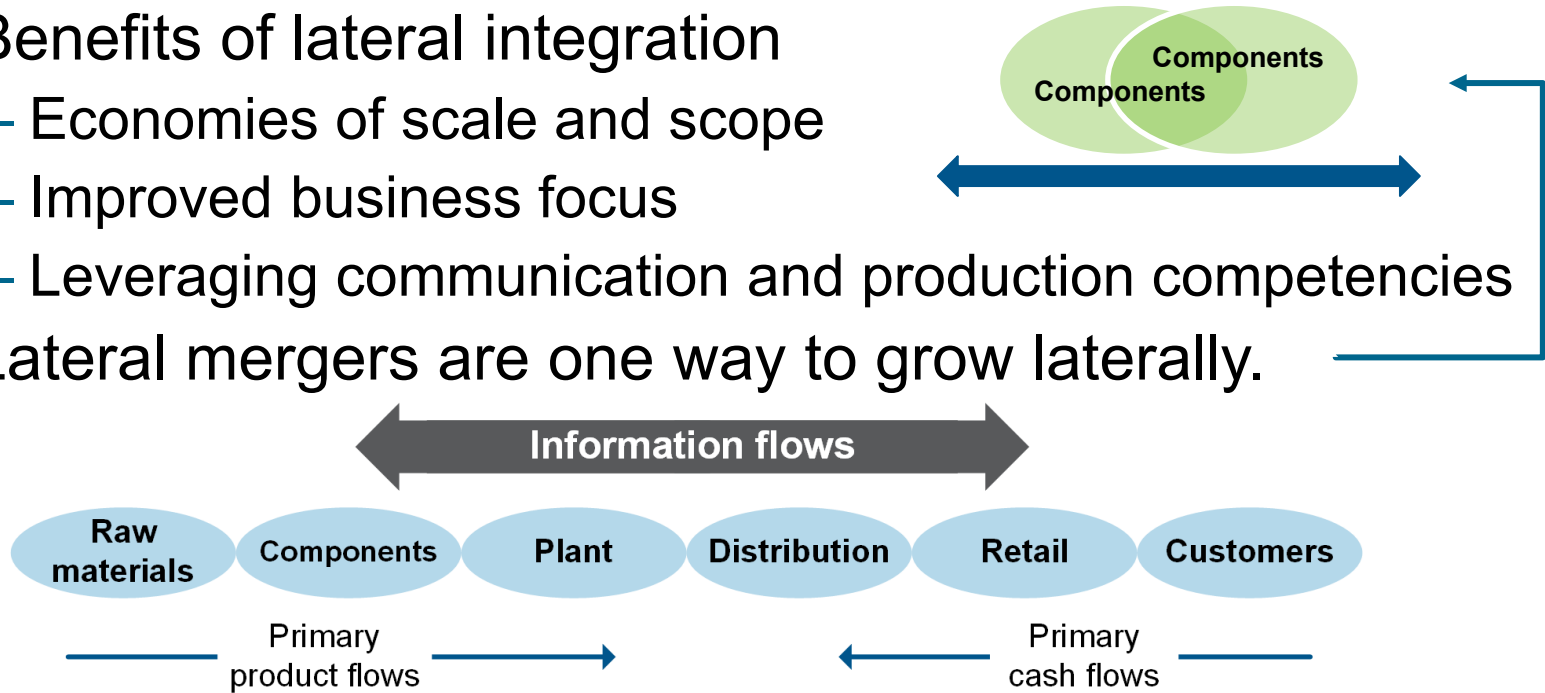
Vertical Integration

- 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



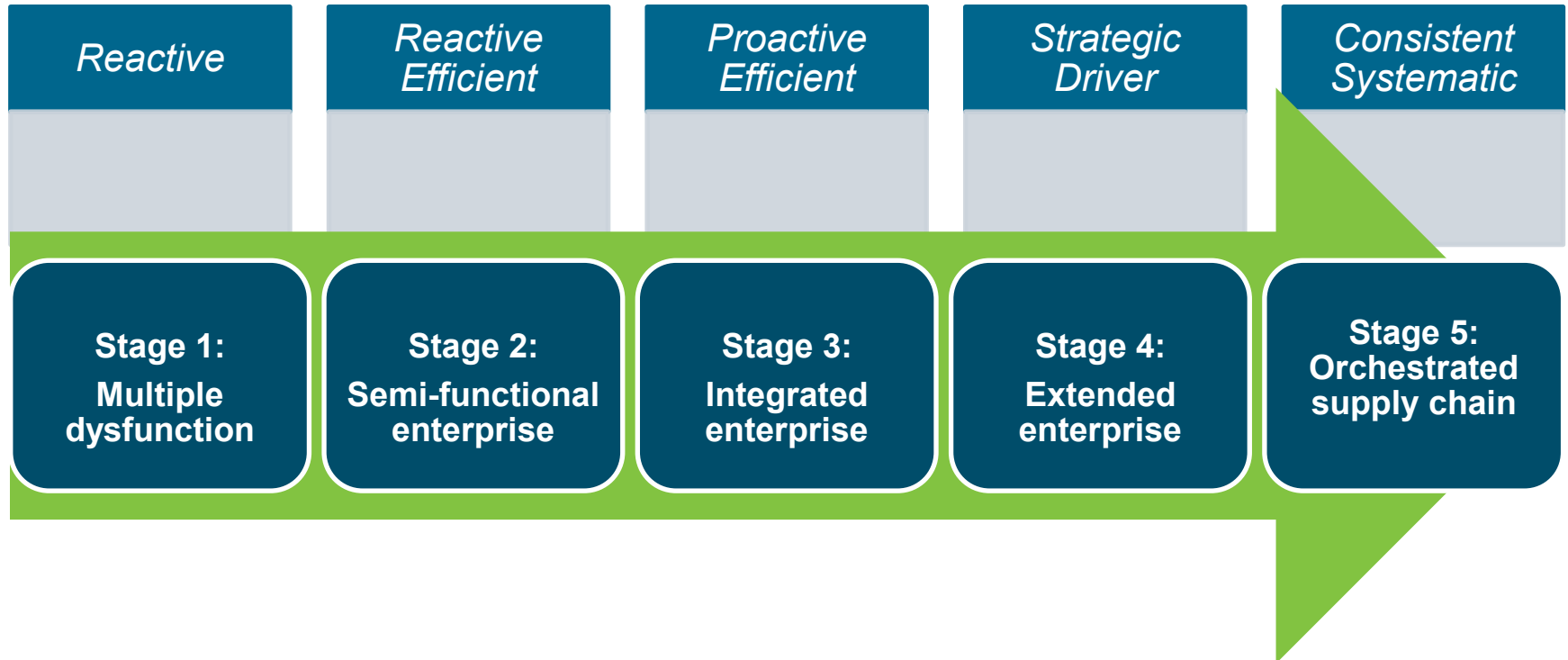
Lateral (Horizontal) Integration

- 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.



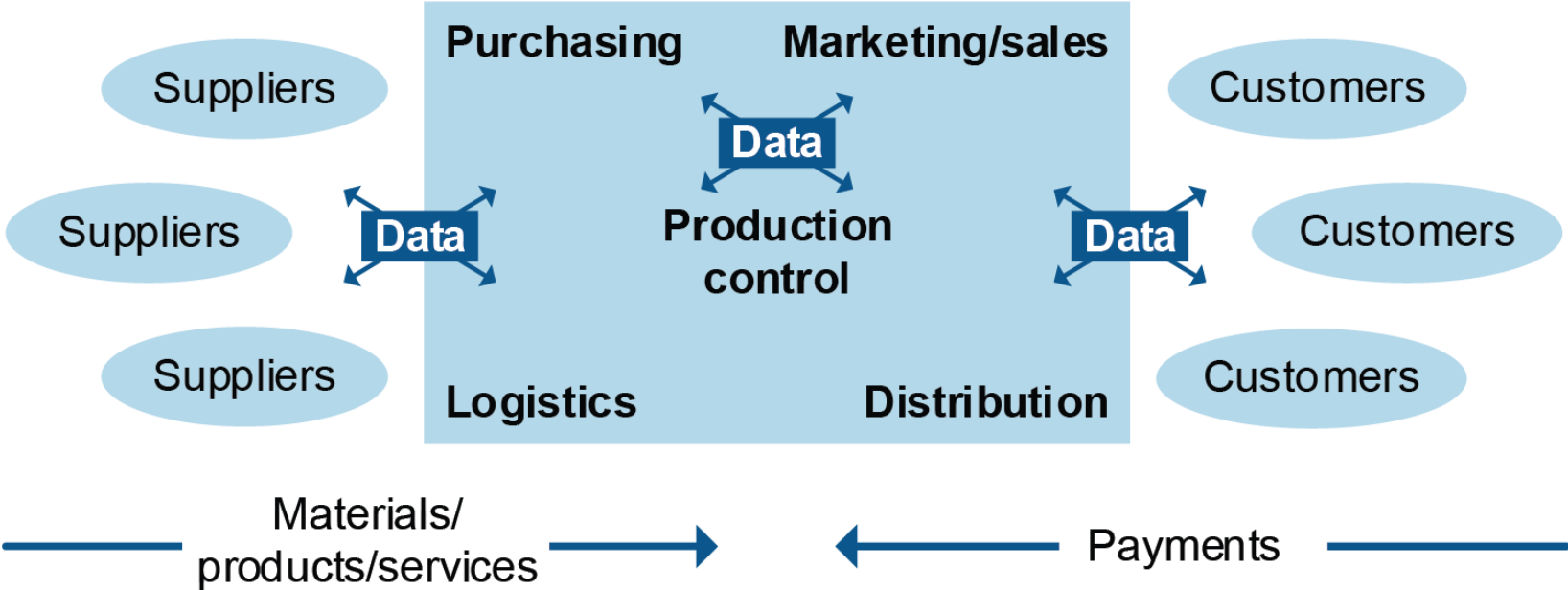
Supply Chain Maturity and Complexity

Supply Chain Stages



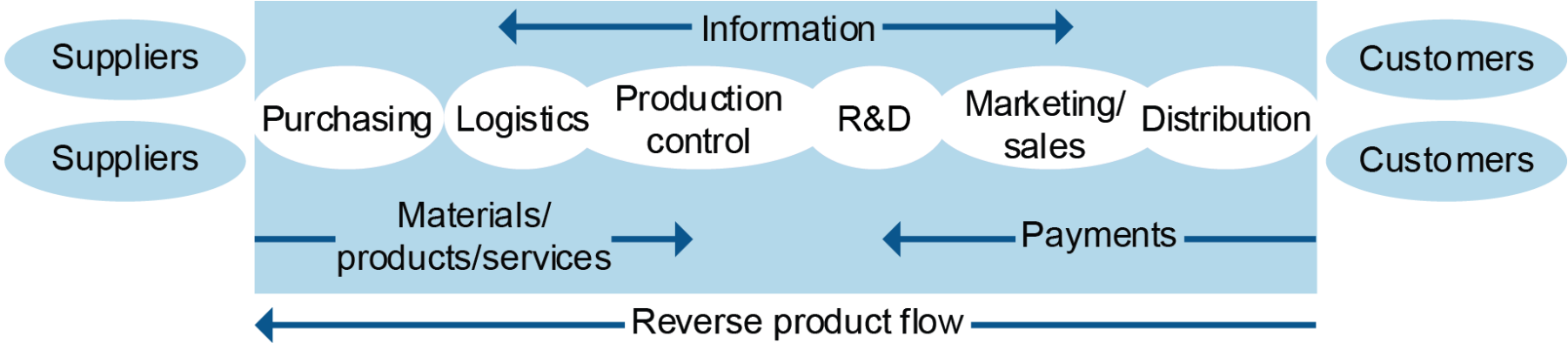
Supply Chain Maturity and Complexity

Stage 1: Multiple Dysfunction



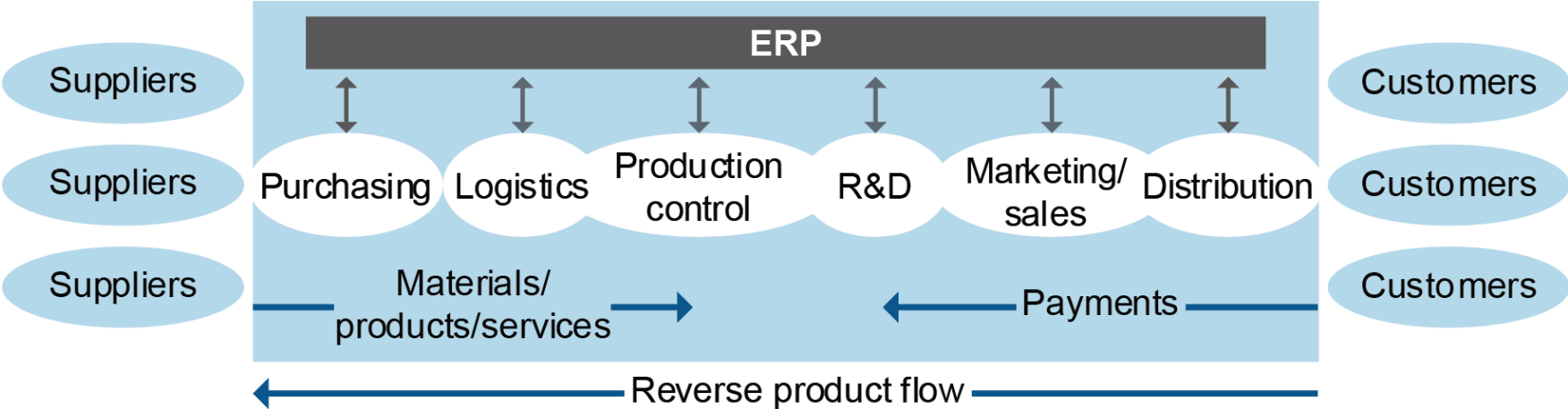
Supply Chain Maturity and Complexity

Stage 2: Semifunctional Enterprise



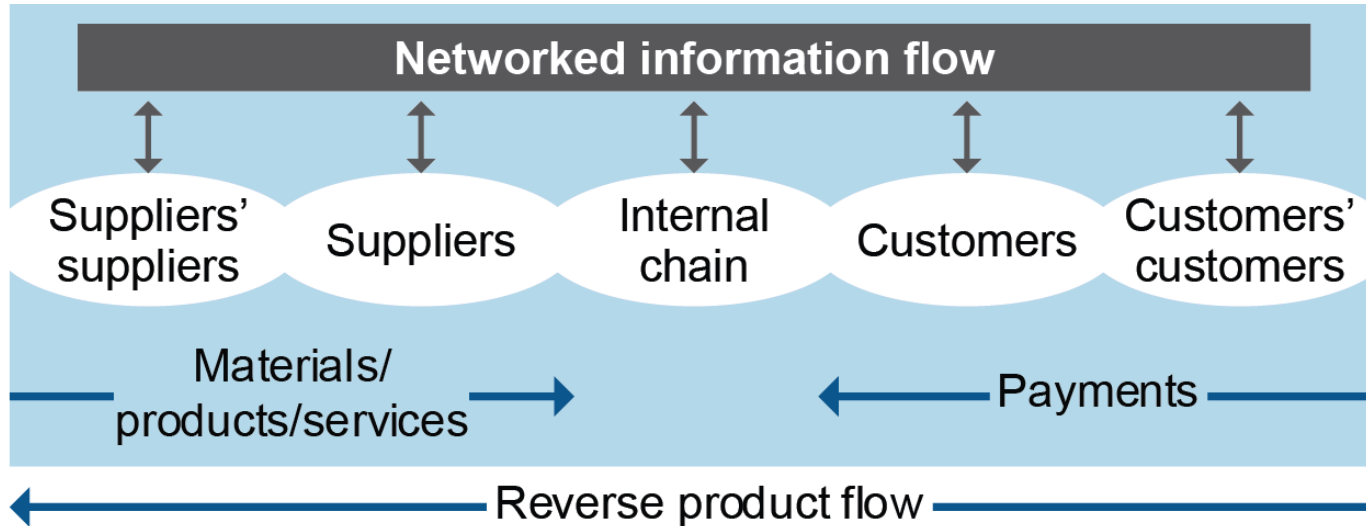
Supply Chain Maturity and Complexity

Stage 3: Integrated Enterprise



Supply Chain Maturity and Complexity

Stage 4: Extended Enterprise



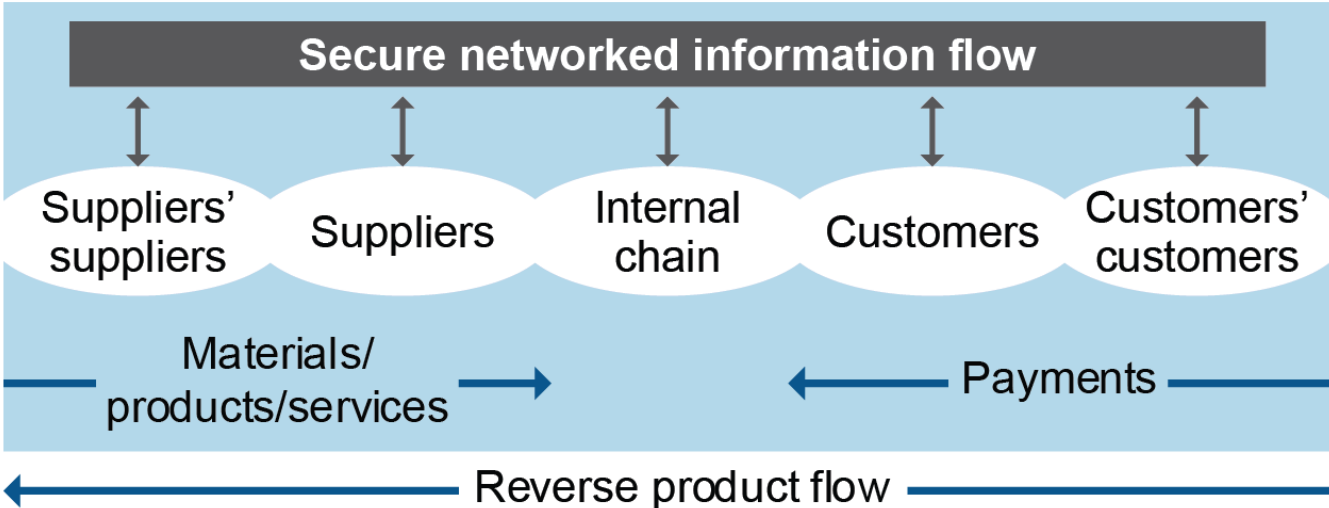
Supply Chain Maturity and Complexity

Stage 5: Orchestrated Supply Chain

Data-driven ♦ Team-driven

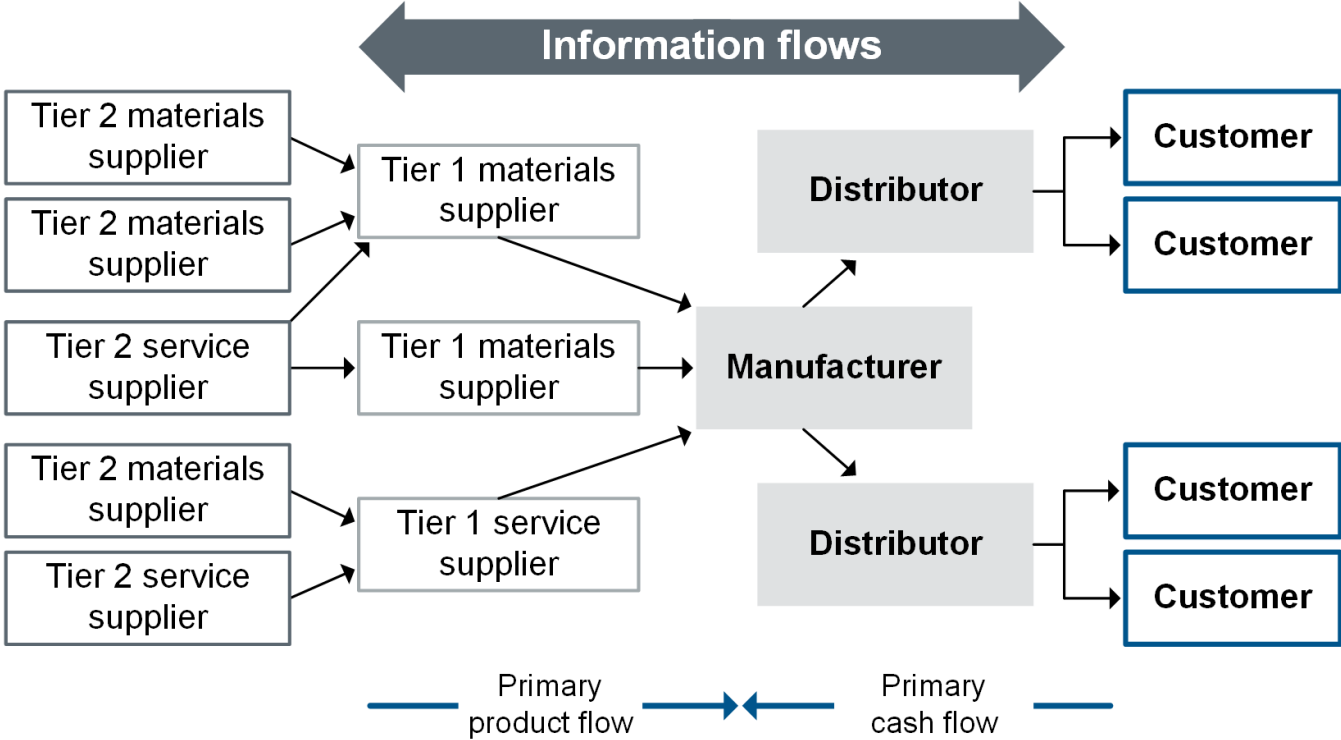
Resiliently sourced ♦ Inclusively designed ♦ Change-ready

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



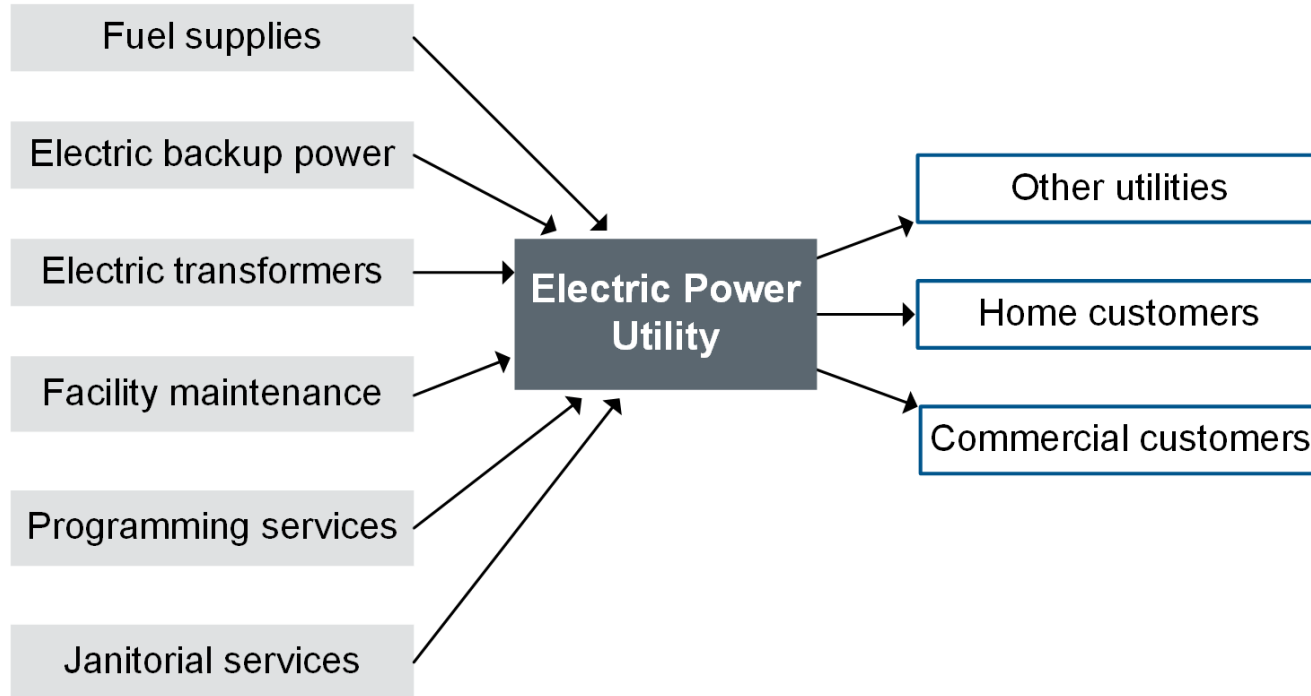
Supply Chain Maturity and Complexity

Manufacturing Supply Chain Model



Supply Chain Maturity and Complexity

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**

Section B Introduction

Section B Key Processes:

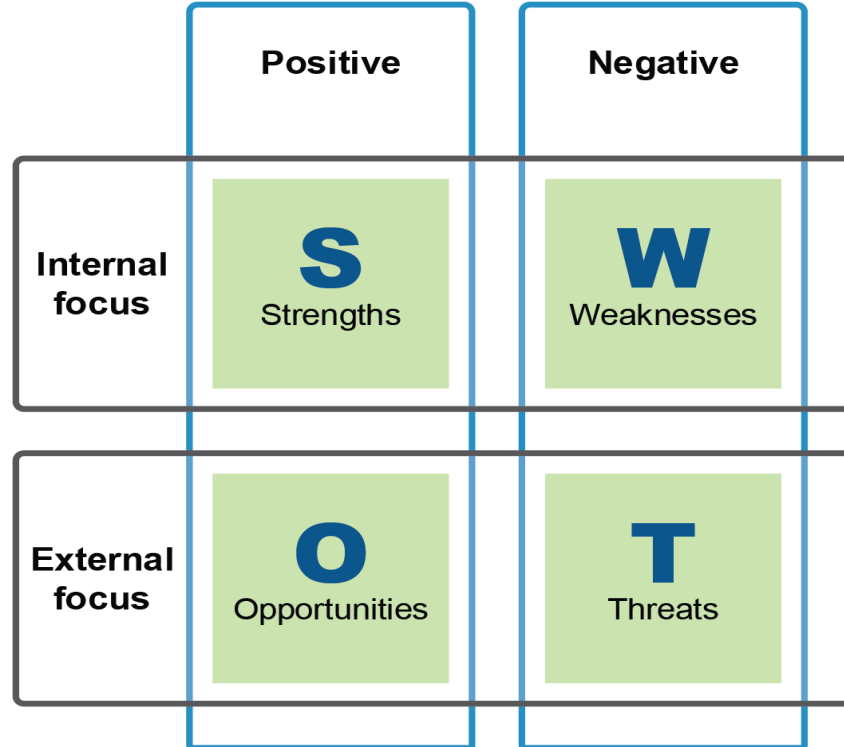
- Collect and analyze historical and environmental demand data.
 - Perform historical analysis.
 - Competitive environment
 - Perform environmental scan and market analysis.
 - Perform product assessment.
 - Demand patterns

Section B Topics:

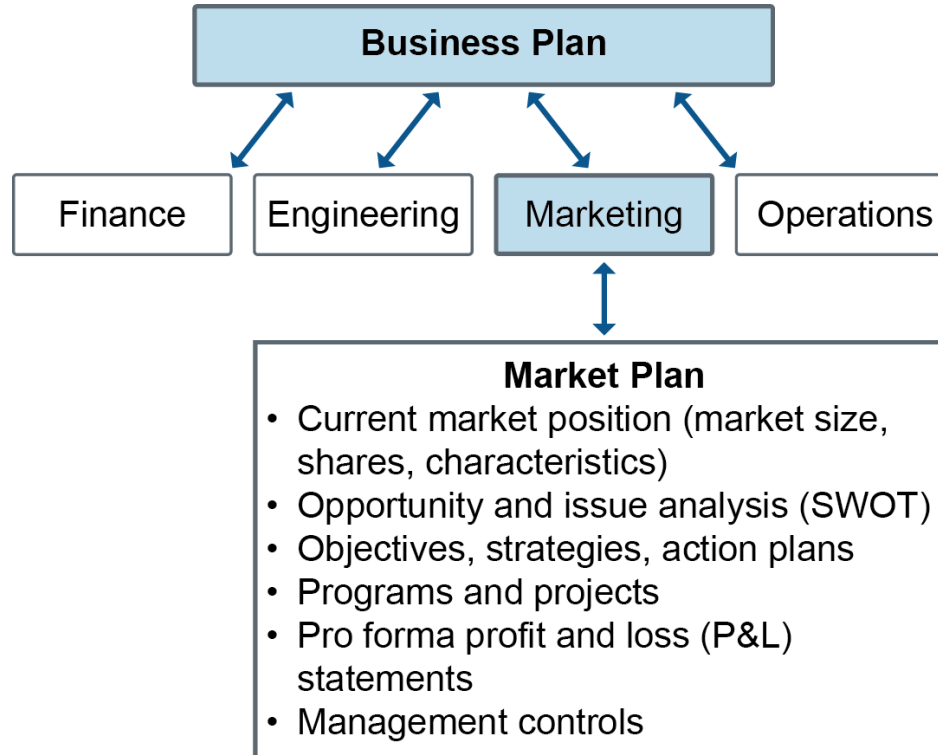
- Demand Analysis
- Demand Patterns

Demand Analysis

SWOT Analysis

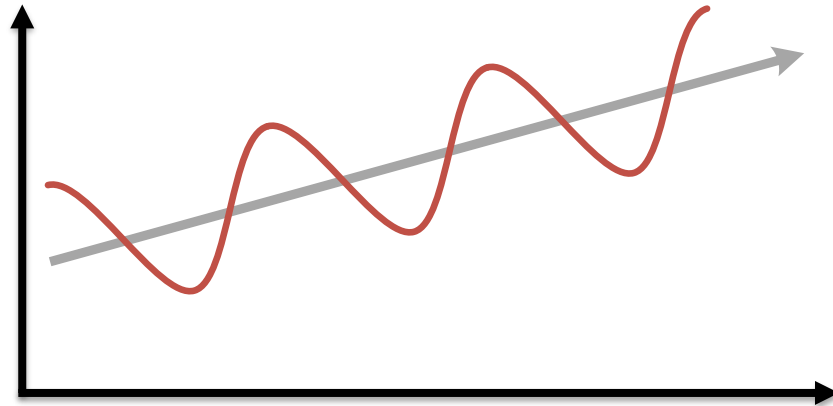


Marketing Strategy and Plan



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

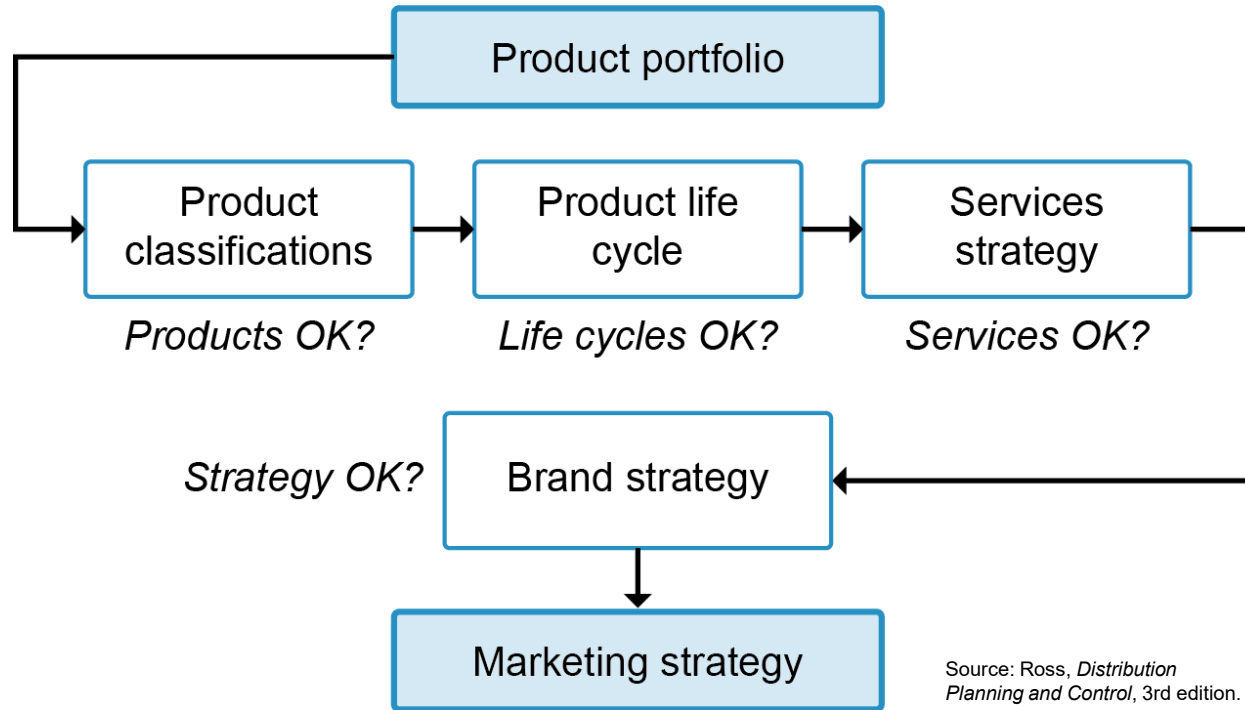


Global Perspectives

- Connected
- Complex
- Volatile



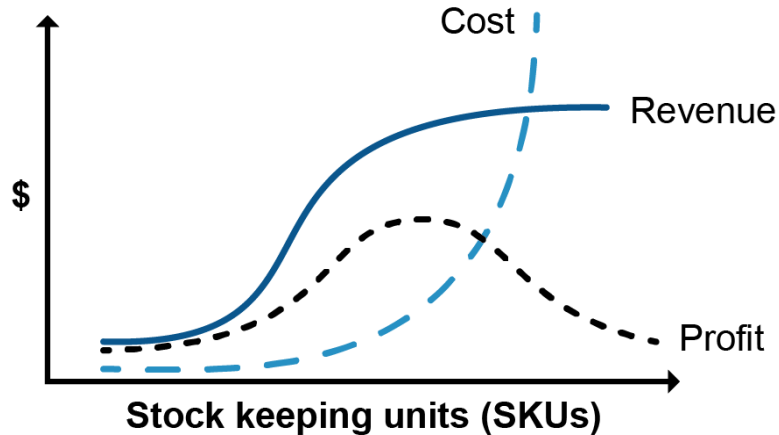
Product Portfolio Management



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

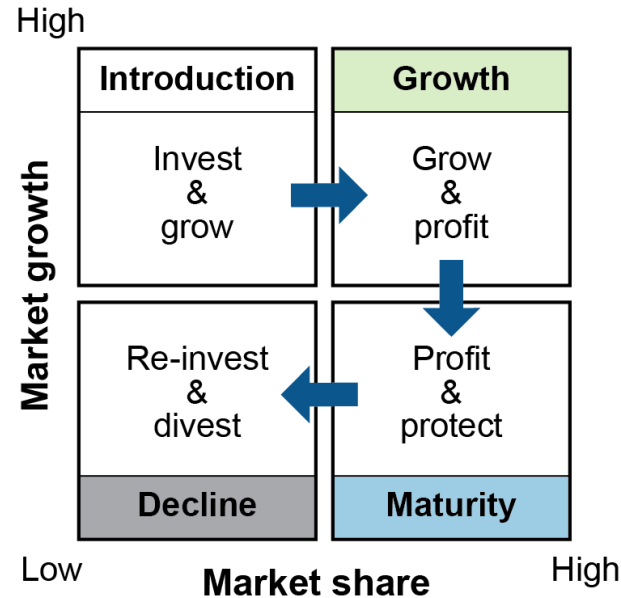
Portfolio Complexity and Life Cycle Reviews

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.

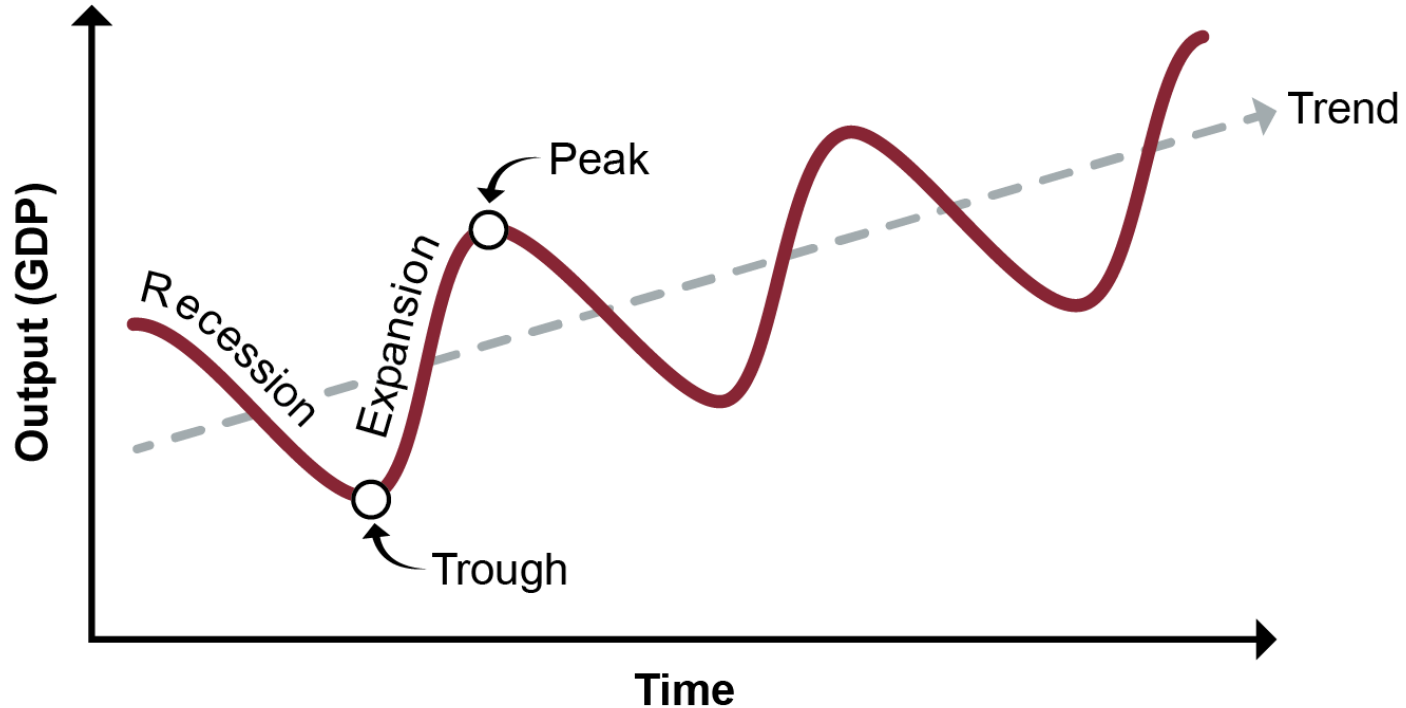
Product Life Cycle Review



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

Demand Patterns

Macroeconomic Demand Patterns

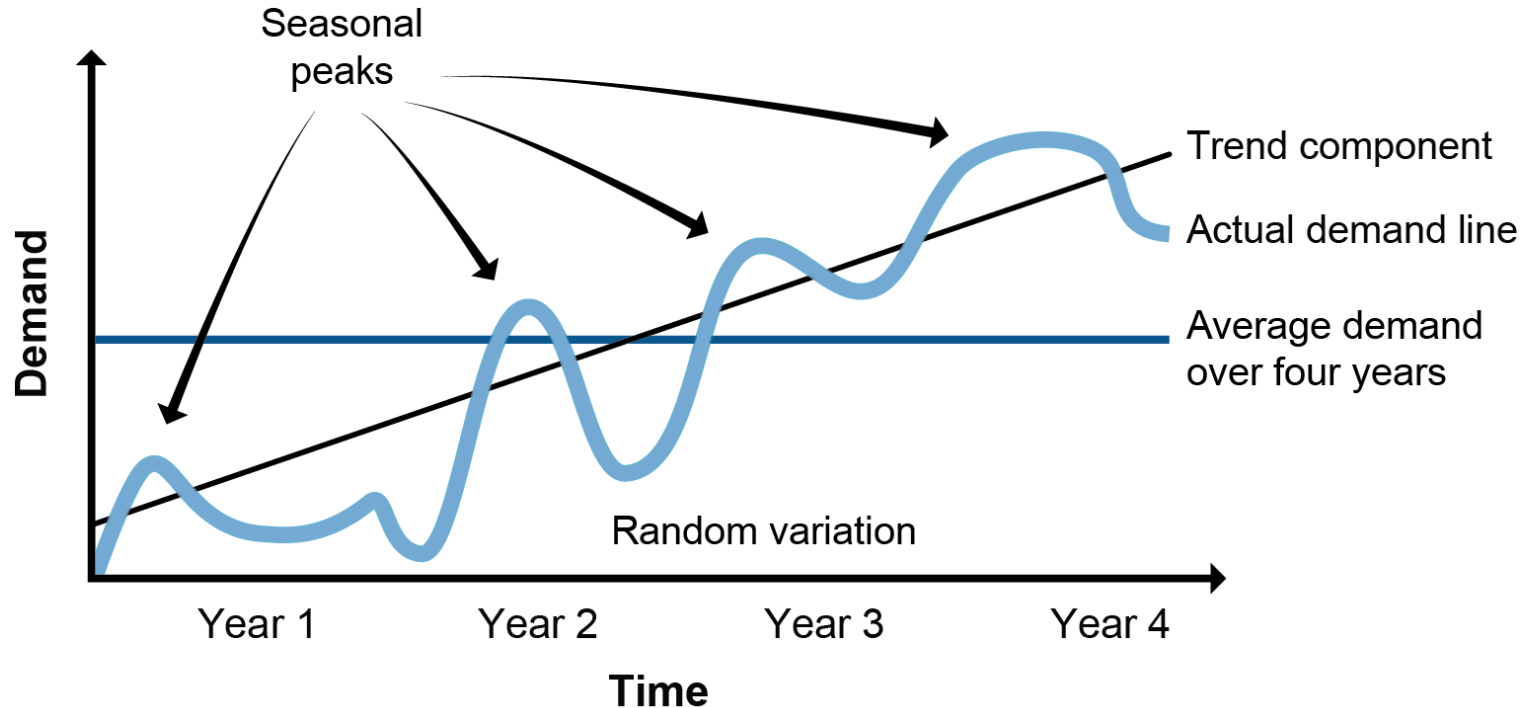


Microeconomics

- 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.

Demand Patterns

Short- to Medium-Term Demand Patterns



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**SECTION C:
DEMAND MANAGEMENT**

Section C Introduction

Section C Key Processes:

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

Section C Topics:

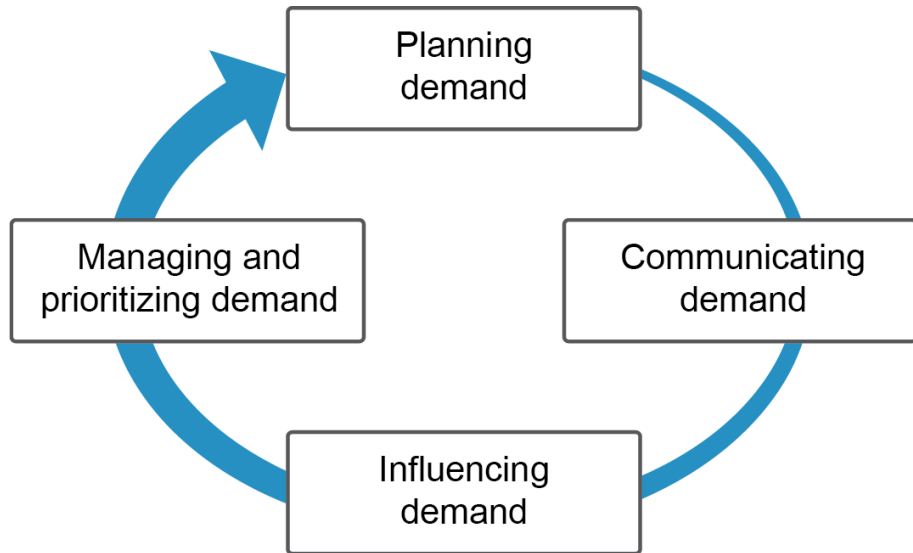
- Demand Management
- Influencing Demand

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

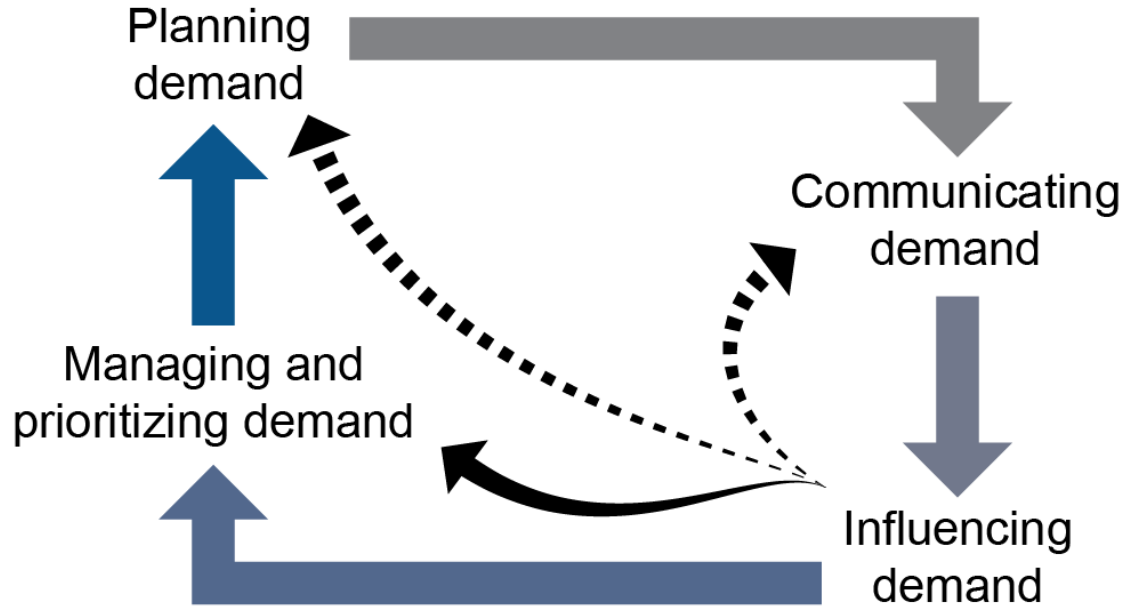
Demand Management Road Map



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

Demand Management

Linkages Among Elements of Demand Management

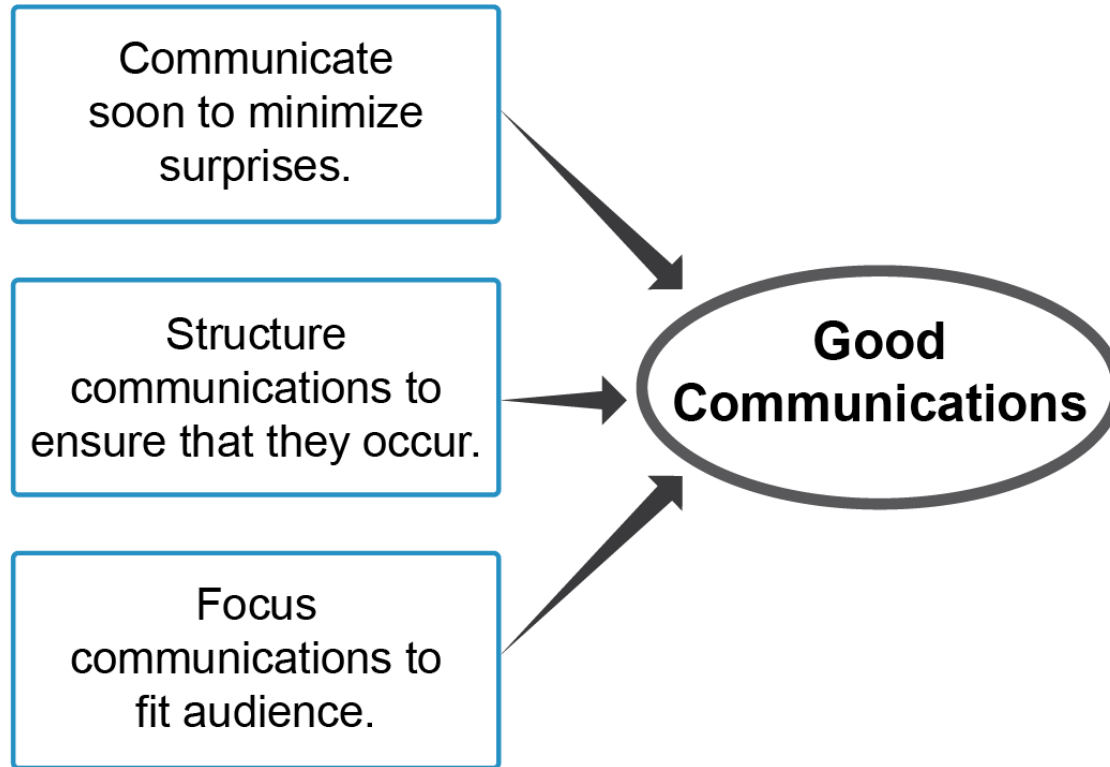


Planning Demand and Demand Plan

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

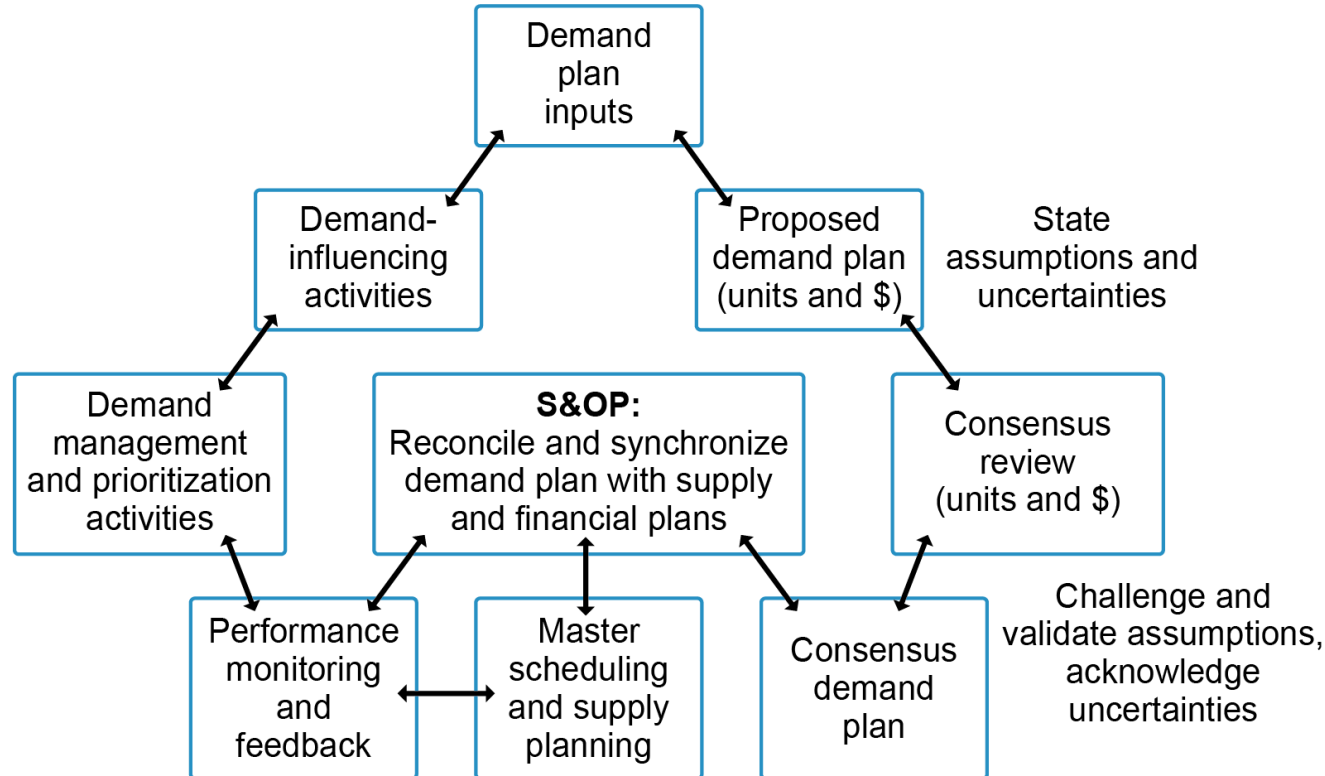


Communicating Demand

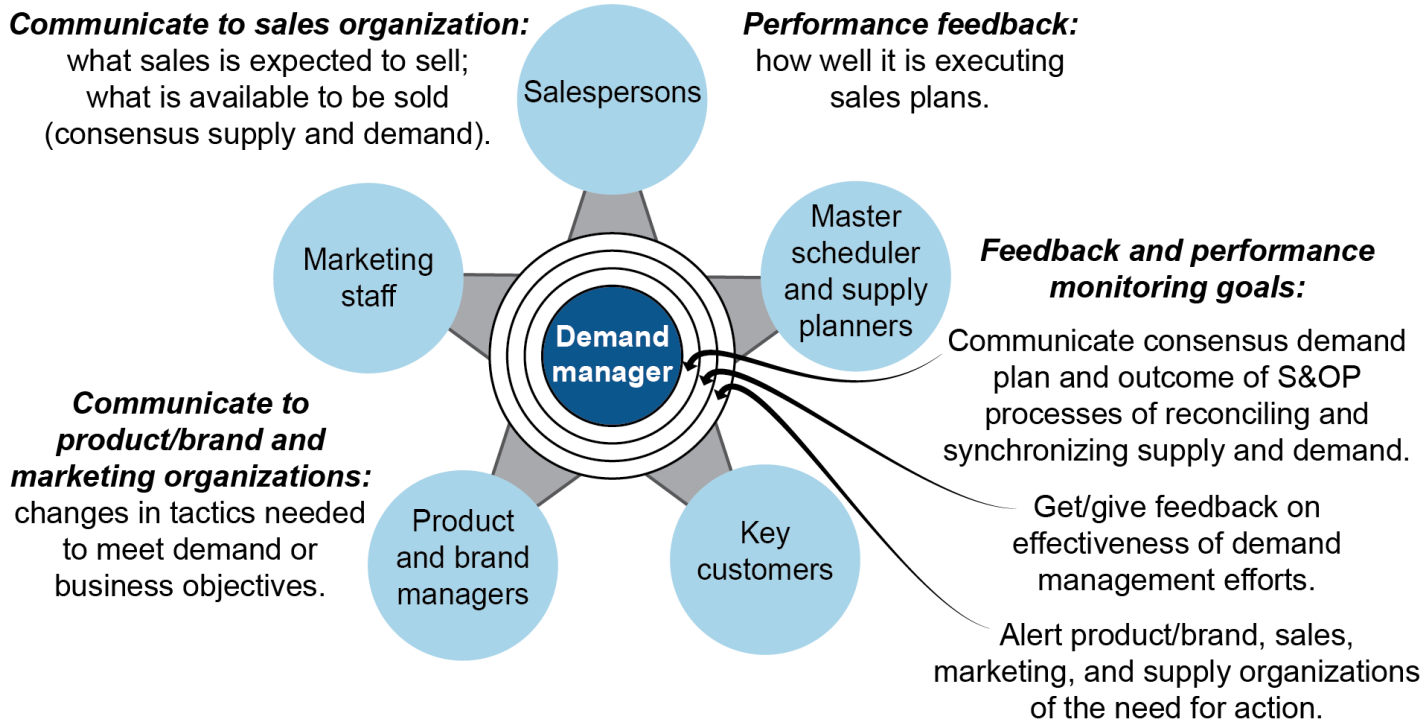


Demand Management

Communications Structure for Communicating Demand

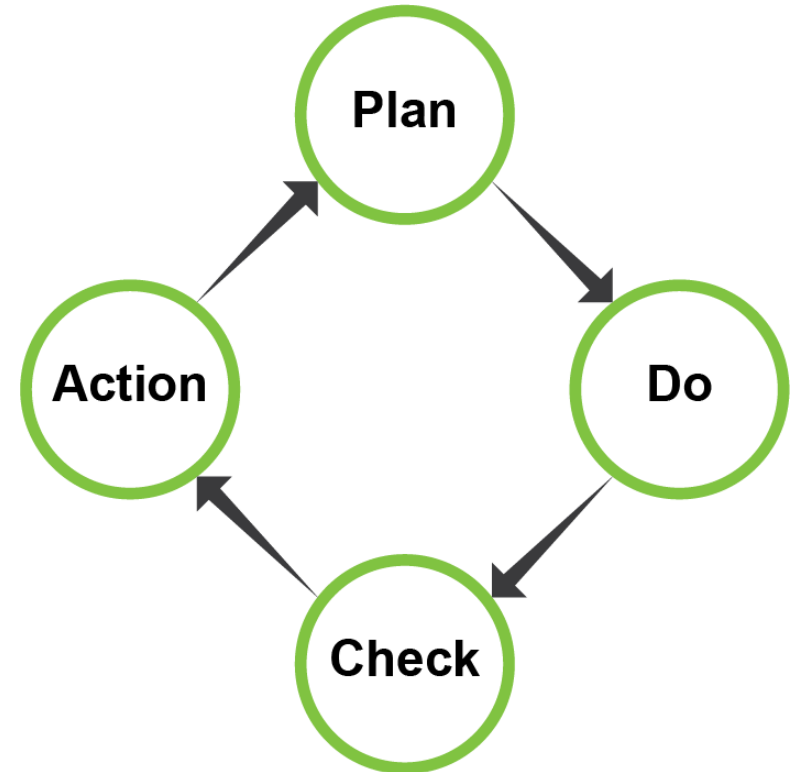


Demand Manager as Focal Point



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

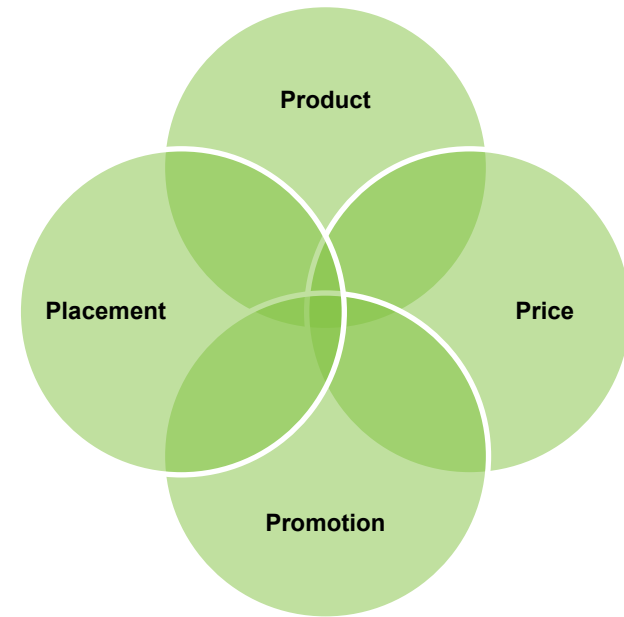


Demand Generation

- 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)

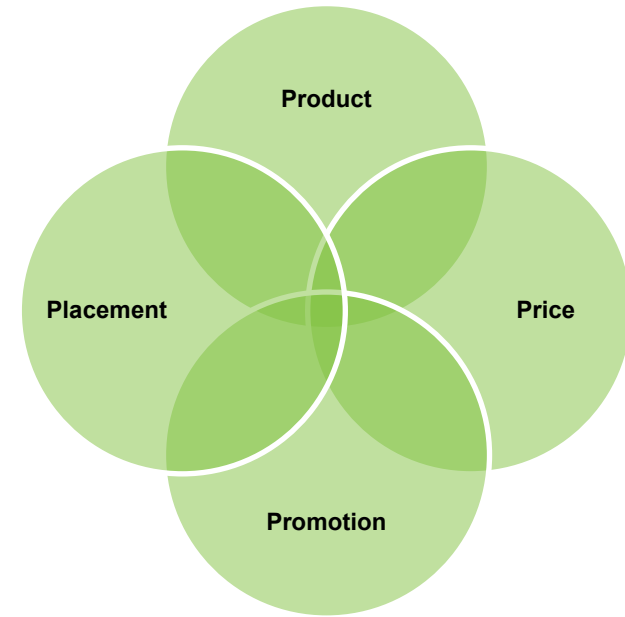
- Was: products identical to all customers; item generated need.
- Is: dynamic; customer need is basis.
- Designed to be customizable for segments.
- Customer care is an implied or explicit product.
- Customized design, manufacture, promotion, distribution, sales methods, and customer care training.



Influencing Demand

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.



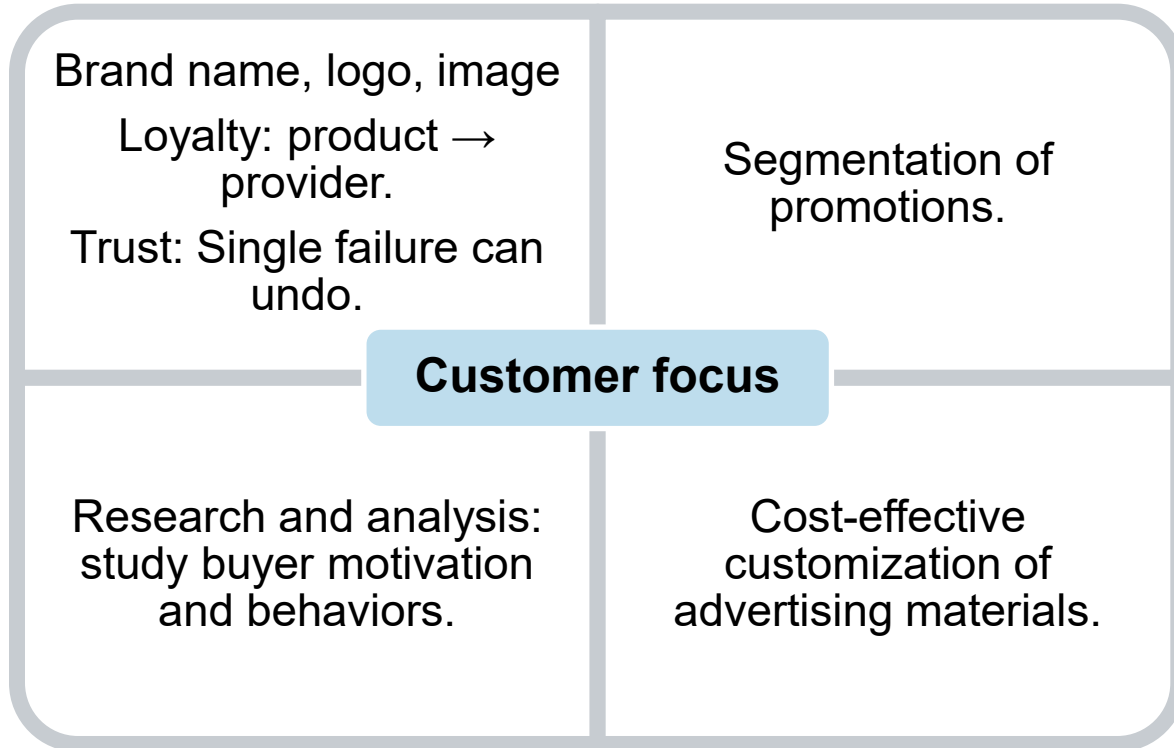
4 Ps: Placement

- 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.

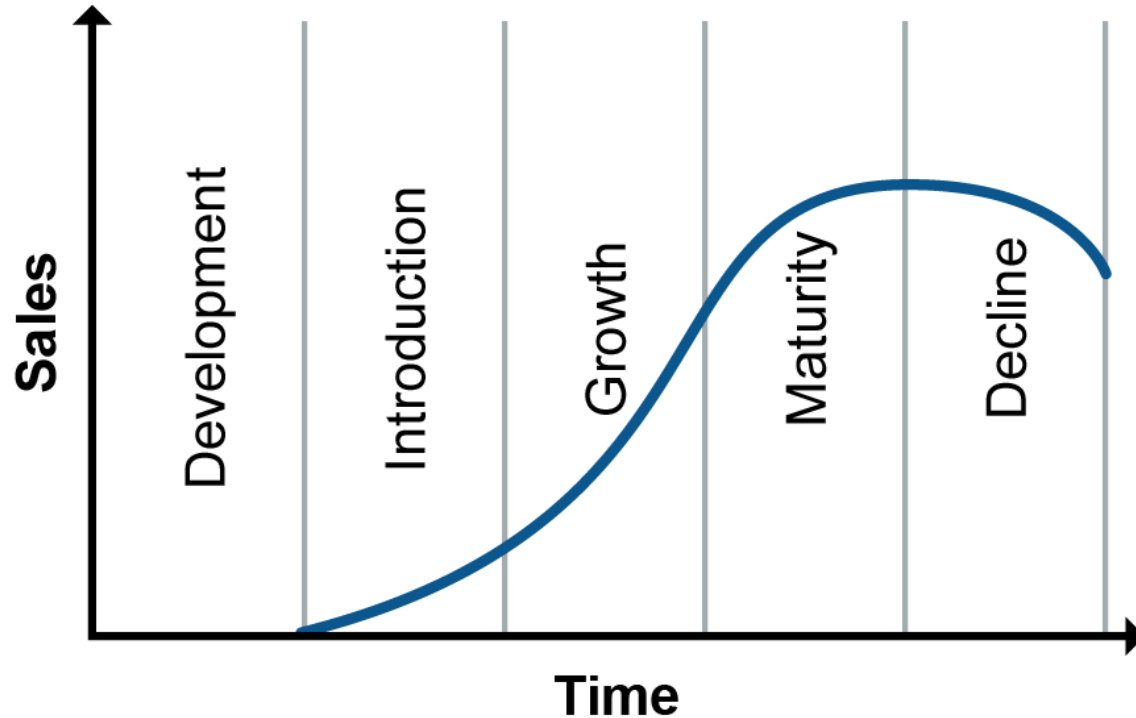


Influencing Demand

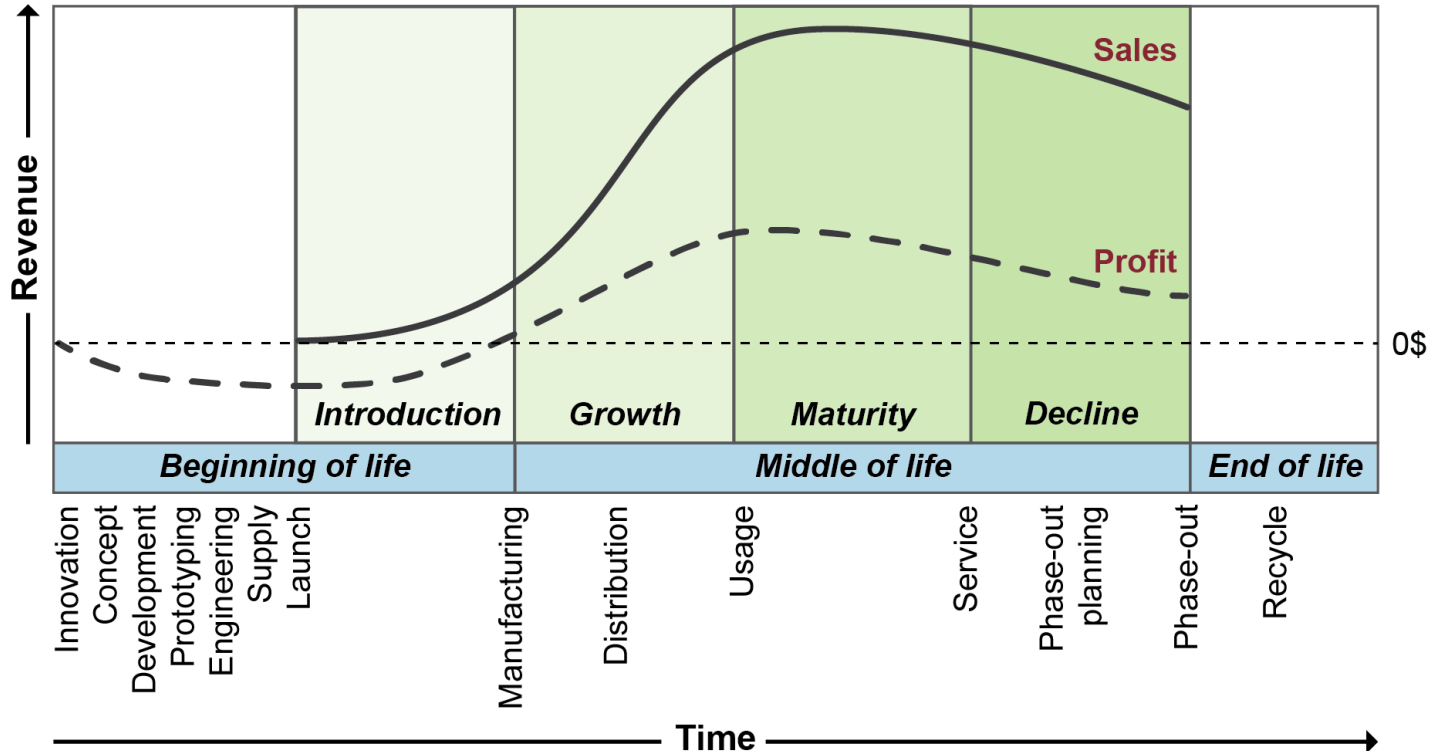
4 Ps: Promotion: Customer-Focused Promotion Activities



Product Life Cycle Stages



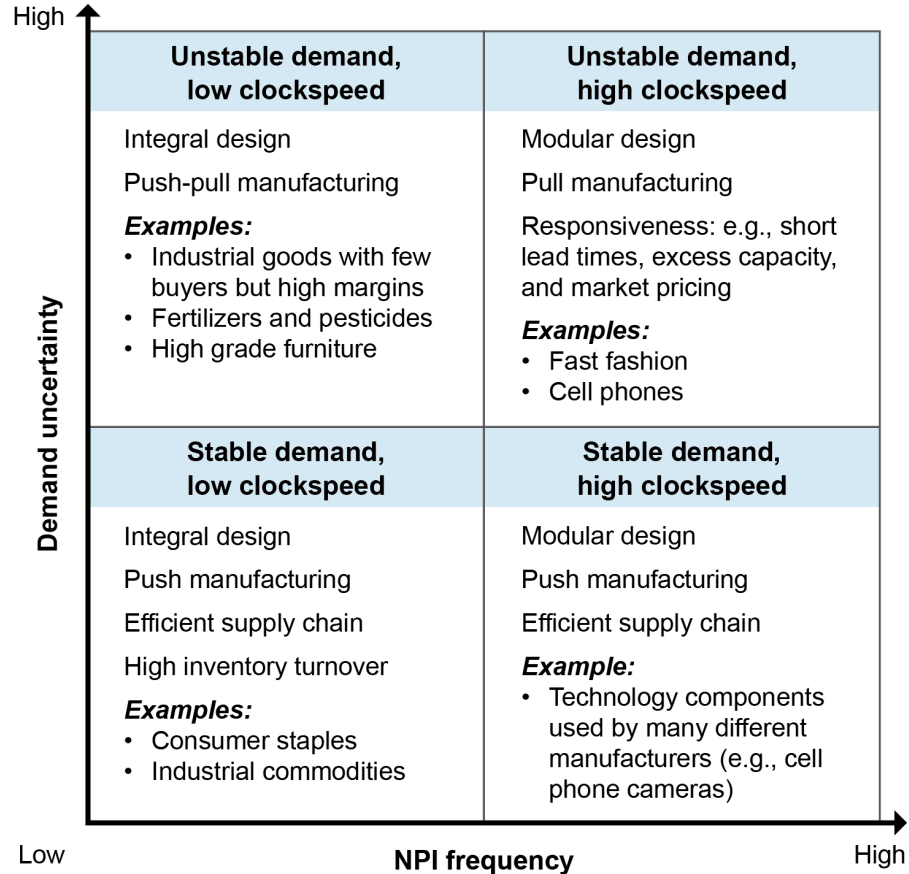
Product Life Cycle Management



Influencing Demand

NPI Frequency versus Demand Uncertainty

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



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SECTION D: FORECASTING

APICS

ASCM

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

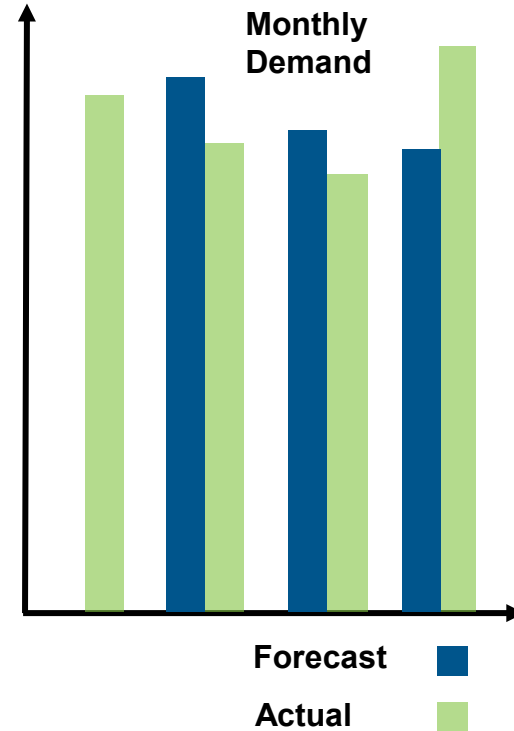
Section D Topics:

- 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.



Qualitative and Combination Methods

- Estimates
 - $$\frac{\text{Optimistic} + (4 \times \text{Most Likely}) + \text{Pessimistic}}{6}$$
- 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 =
$$\frac{\text{Average Demand for Period (e.g., Month)}}{\text{Average Demand for all Periods (e.g., Year)}}$$

Forecasting Methods

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 = $\frac{(M1 + M2 + M3)}{3} =$
 $\frac{14.00 + 15.35 + 13.53}{3} = 14.3$

- Smooths out irregular demand, but lags trend

- Weighted moving average:

- 3-Month Weighted Moving Average = $\frac{(1 \times M1) + (2 \times M2) + (3 \times M3)}{6} =$
 $\frac{(17.5) + (2 \times 35) + (3 \times 21)}{6} = 25.08$

- Also smooths, but lags trend less

Exponential Smoothing

- Inputs: last period's forecast, last period's demand, and alpha
 - New Forecast =
 $(\alpha \times \text{Last Period's Demand}) + [(1 - \alpha) \times \text{Last Period's Forecast}]$
- Alpha, α , a smoothing constant between 0 and 1
 - Example: 0.3, 30% weight on demand, 70% on forecast,
 $(0.3 \times 15.40) + [(0.7) \times 22.72] = 20.52$
 - 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	15.35
58	Feb	14.11	14.50	15.48	13.53
59	Mar	14.30	14.22	14.90	16.55
60	Apr	15.14	15.34	15.39	17.50
61	May	15.86	16.52	16.02	35.00
62	Jun	23.02	26.09	21.72	21.00
63	Jul	24.50	25.08	21.50	28.00
64	Aug	28.00	26.83	23.45	21.00
65	Sep	23.33	23.33	22.72	15.40
66	Oct	21.47	19.37	20.52	16.00
67	Nov	17.47	16.63	19.16	15.56
68	Dec	15.65	15.68	18.08	14.44

Forecasting over longer periods results in same value repeated.

		Moving Average	Weighted Average
20			
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 Methods

Reseasonalizing

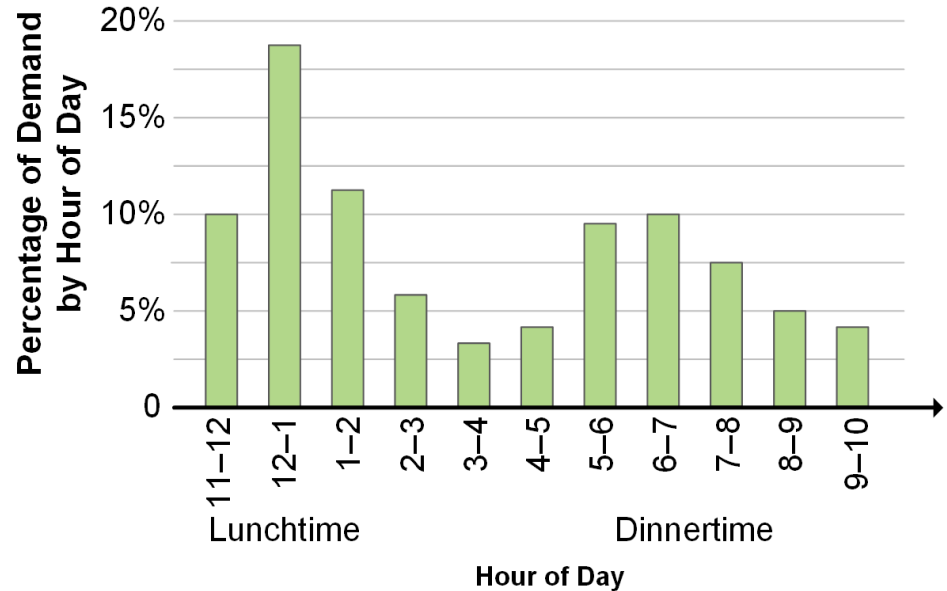
	A	I	O	P	Q	R	S	T	U
1			Deseasonalized			Year 4 Reseasonalized Forecasts			
2	Month	Seasonal Index	Moving Year 4	Weighted Year 4	Expon. Year 4	Moving Average	Weighted Average	Exponential	Year 4 Raw Actuals
3	Jan	2.214	13.99	13.82	15.54	30.97	30.60	34.40	34
4	Feb	2.143	14.11	14.50	15.48	30.23	31.08	33.17	29
5	Mar	0.786	14.30	14.22	14.90	11.23	11.17	11.70	13
6	Apr	0.286	15.14	15.34	15.39	4.33	4.38	4.40	5
7	May	0.143	15.86	16.52	16.02	2.27	2.36	2.29	5
8	Jun	0.143	23.02	26.09	21.72	3.29	3.73	3.10	3
9	Jul	0.071	24.50	25.08	21.50	1.75	1.79	1.54	2
10	Aug	0.286	28.00	26.83	23.45	8.00	7.67	6.70	6
11	Sep	0.714	23.33	23.33	22.72	16.67	16.67	16.23	11
12	Oct	1.000	21.47	19.37	20.52	21.47	19.37	20.52	16
13	Nov	1.929	17.47	16.63	19.16	33.69	32.08	36.96	30
14	Dec	2.286	15.65	15.68	18.08	35.78	35.83	41.33	33

$$0.786 \times 14.30 = 11.23$$

$$0.071 \times 25.08 = 1.79$$

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

- Unemployment rate
- Outstanding loans
- Inventory to sales
- Changes in company profits
- Spending by businesses
- Consumer price index (CPI)
- Average duration of unemployment

Leading Indicators

- Building permits
- Initial unemployment claims
- Orders for plant equipment, durable goods and materials
- Changes in money supply
- S&P 500
- Long- vs. short-term rates
- Consumer optimism

Past and current trends

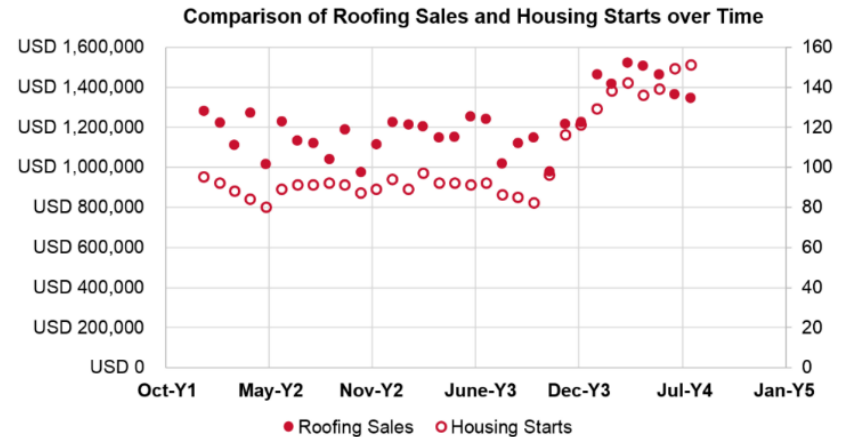
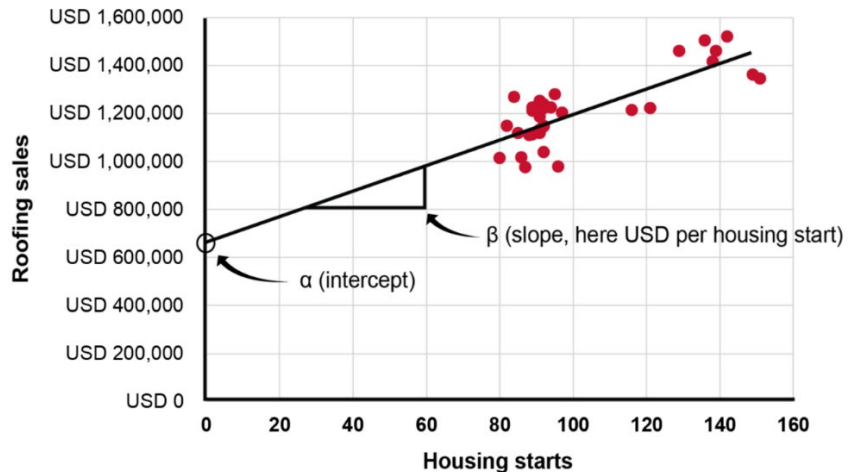
Future trends



Forecasting Methods

Associative Forecasting

- $y = \alpha + \beta x$
- Roofing Sales = $\alpha + (\beta \times \text{Prior Month's Housing Starts})$



Forecast Error

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

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

Measures of Forecast Error

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.

Measures of Forecast Error

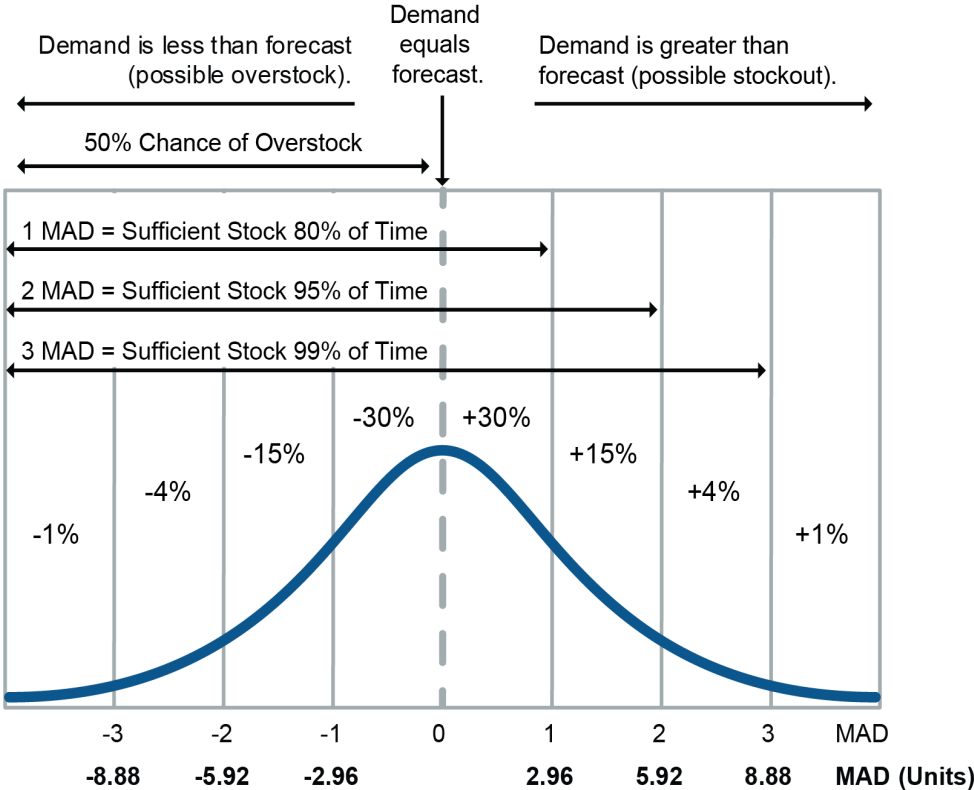
Mean Absolute Deviation (MAD) with Smoothing

	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	30.23	31.08	33.17	29	1.23	2.08	4.17
5	11.23	11.17	11.70	13	1.77	1.83	1.30
6	4.33	4.38	4.40	5	0.67	0.62	0.60
7	2.27	2.36	2.29	5	2.73	2.64	2.71
8	3.29	3.73	3.10	3	0.29	0.73	0.10
9	1.75	1.79	1.54	2	0.25	0.21	0.46
10	8.00	7.67	6.70	6	2.00	1.67	0.70
11	16.67	16.67	16.23	11	5.67	5.67	5.23
12	21.47	19.37	20.52	16	5.47	3.37	4.52
13	33.69	32.08	36.96	30	3.69	2.08	6.96
14	35.78	35.83	41.33	33	2.78	2.83	8.33
15				SUM	29.56	27.11	35.49
16				MAD	2.46	2.26	2.96

- $$MAD = \frac{\sum |A - F|}{n} = \frac{35.49}{12} = 2.96 \text{ units}$$
- Note: the Greek uppercase letter Σ stands for “the sum of.”

Measures of Forecast Error

Distribution Curve for MAD of 2.96 Units

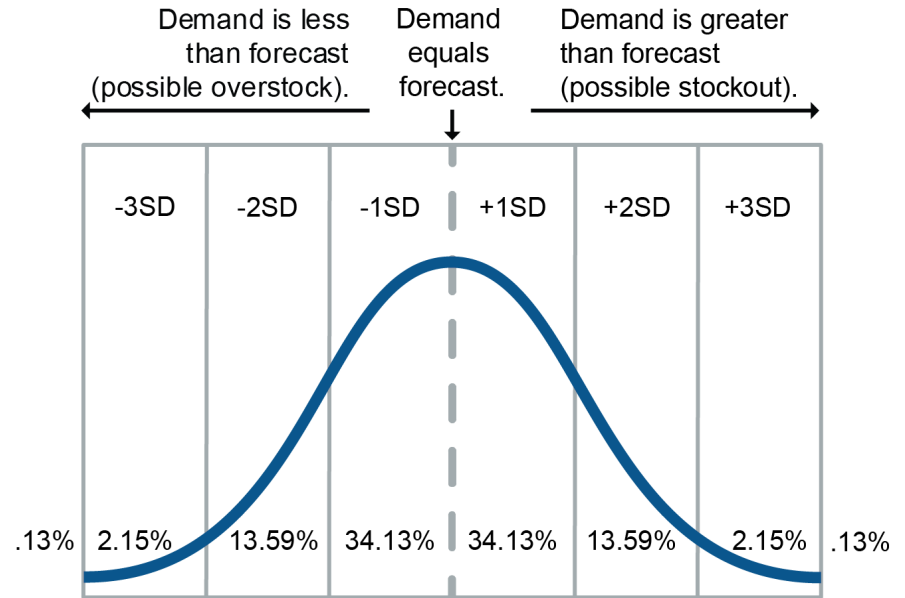


Measures of Forecast Error

Standard Deviation

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

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



Other Measures of Forecast Error

- Tracking Signal = $\frac{\text{Algebraic Sum of Forecast Errors}}{\text{Mean Absolute Deviation}} = \frac{-25.34}{2.96} = -8.57$
- MSE = $\frac{\sum(\text{Errors for Each Period})^2}{\text{Number of Forecast Periods}} = \frac{35.49}{12} = 16.11$
- MAPE = $\frac{\sum\left(\frac{|A-F|}{A}\right)}{n} = \frac{254.3\%}{12} = 21.2\%$

Measures of Forecast Error

MAD, Tracking Signal, and MSE

	U	V	W	X	AB	AC	AD	AE	AF	AG
1	Absolute Errors									
	Year 4 Raw	Moving	Weighted	Expon.	Moving	Weighted	Expon.	Squared	Squared	Squared
2	Actuals	Error	Error	Error	Error +/-	Error +/-	Error +/-	Moving	Weighted	Expon.
3	34	3.03	3.40	0.40	3.03	3.40	-0.40	9.16	11.54	0.16
4	29	1.23	2.08	4.17	-1.23	-2.08	-4.17	1.51	4.33	17.42
5	13	1.77	1.83	1.30	1.77	1.83	1.30	3.12	3.34	1.68
6	5	0.67	0.62	0.60	0.67	0.62	0.60	0.45	0.38	0.36
7	5	2.73	2.64	2.71	2.73	2.64	2.71	7.48	6.97	7.35
8	3	0.29	0.73	0.10	-0.29	-0.73	-0.10	0.08	0.53	0.01
9	2	0.25	0.21	0.46	0.25	0.21	0.46	0.06	0.04	0.22
10	6	2.00	1.67	0.70	-2.00	-1.67	-0.70	4.00	2.78	0.49
11	11	5.67	5.67	5.23	-5.67	-5.67	-5.23	32.11	32.11	27.31
12	16	5.47	3.37	4.52	-5.47	-3.37	-4.52	29.88	11.33	20.44
13	30	3.69	2.08	6.96	-3.69	-2.08	-6.96	13.58	4.32	48.45
14	33	2.78	2.83	8.33	-2.78	-2.83	-8.33	7.70	8.04	69.39
15	SUM	29.56	27.11	35.49	-12.66	-9.73	-25.34	109.15	85.71	193.28
16	MAD	2.46	2.26	2.96						
17	MSE	9.10	7.14	16.11						
	Tracking									
19	Signal	-5.14	-4.31	-8.57						

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	30.23	31.08	33.17	29	1.23	2.08	4.17	4.2%	7.2%	14.4%		
5	11.23	11.17	11.70	13	1.77	1.83	1.30	13.6%	14.1%	10.0%		
6	4.33	4.38	4.40	5	0.67	0.62	0.60	13.5%	12.3%	12.0%		
7	2.27	2.36	2.29	5	2.73	2.64	2.71	54.7%	52.8%	54.2%		
8	3.29	3.73	3.10	3	0.29	0.73	0.10	9.6%	24.2%	3.4%		
9	1.75	1.79	1.54	2	0.25	0.21	0.46	12.5%	10.4%	23.2%		
10	8.00	7.67	6.70	6	2.00	1.67	0.70	33.3%	27.8%	11.7%		
11	16.67	16.67	16.23	11	5.67	5.67	5.23	51.5%	51.5%	47.5%		
12	21.47	19.37	20.52	16	5.47	3.37	4.52	34.2%	21.0%	28.3%		
13	33.69	32.08	36.96	30	3.69	2.08	6.96	12.3%	6.9%	23.2%		
14	35.78	35.83	41.33	33	2.78	2.83	8.33	8.4%	8.6%	25.2%		
15				SUM	29.56	27.11	35.49	256.7%	246.9%	254.3%		
16				MAD	2.46	2.26	2.96					
17				MSE	9.10	7.14	16.11					
18				MAPE	21.4%	20.6%	21.2%					

CSCP

CERTIFIED SUPPLY CHAIN
PROFESSIONAL

SECTION E: SUPPLY AND DEMAND ALIGNMENT

Section E Introduction

Section E Key Processes:

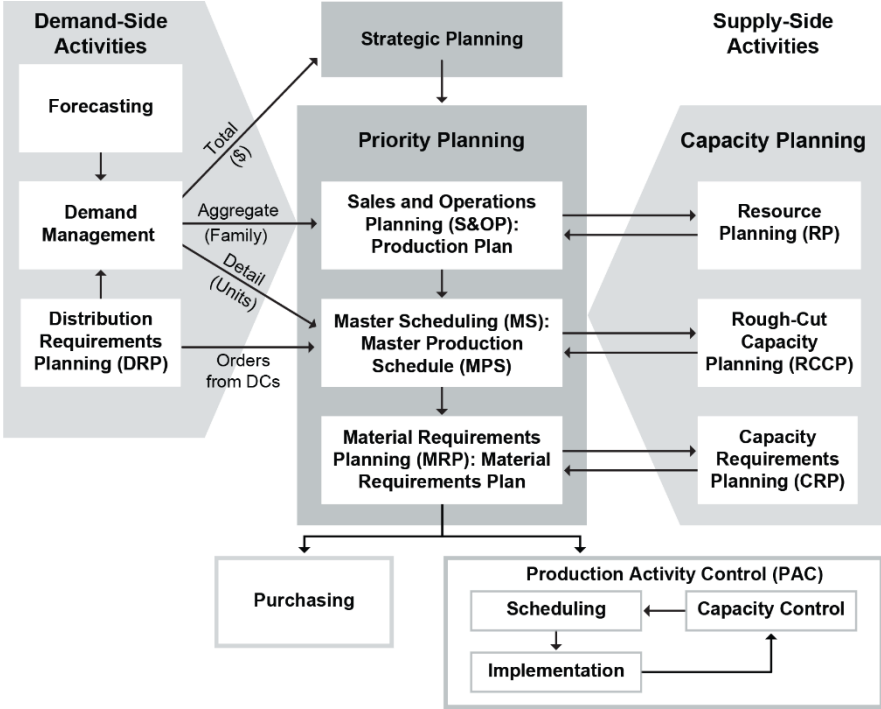
- Align supply with demand.
 - Execute sales and operations planning (S&OP) process.
 - Manage inputs and outputs.
 - Perform reconciliation and analysis.

Section E Topics:

- Supply and Demand Alignment
- Sales and Operations Planning

Supply and Demand Alignment

Operations Planning and Control



Supply and Demand Alignment

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

- 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

Resource Planning

- 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

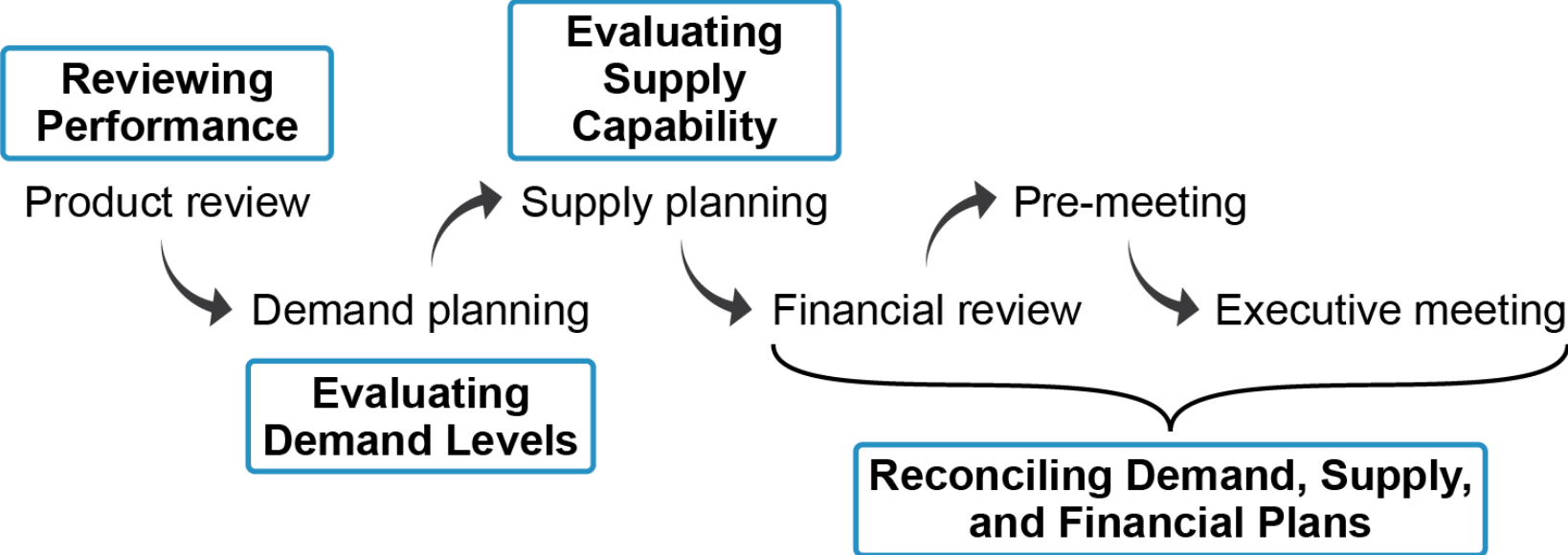
Sales and Operations Planning

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

Sales and Operations Planning (S&OP)

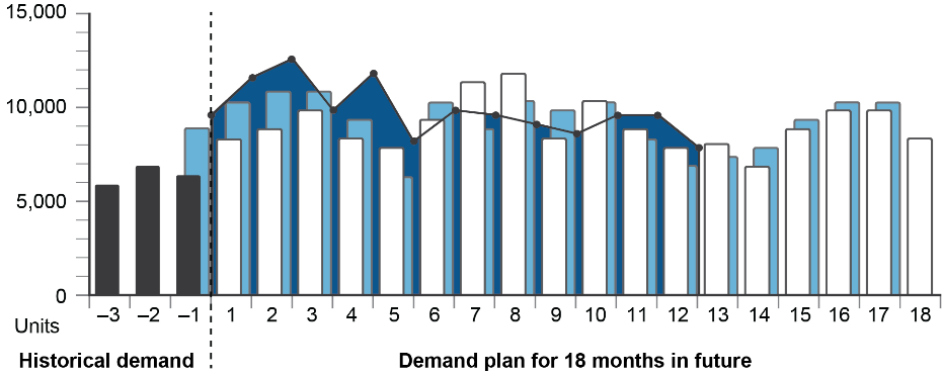


Demand Planning Phase Meeting

- 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.

Sales and Operations Planning

Demand Plan Dashboard in Units



Key:

- Actual demand (black bar)
- Annual business plan (line with shaded area)
- Prior demand plan (light blue bar)
- Current demand plan (dark blue bar)

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.



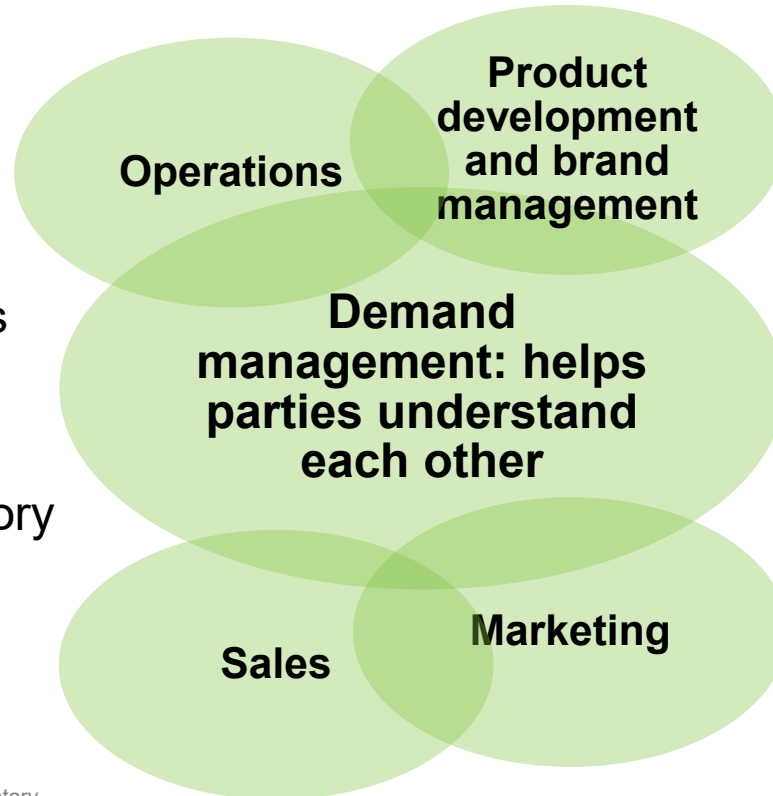
Supply/Demand Mismatch

- 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).

Sales and Operations Planning

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

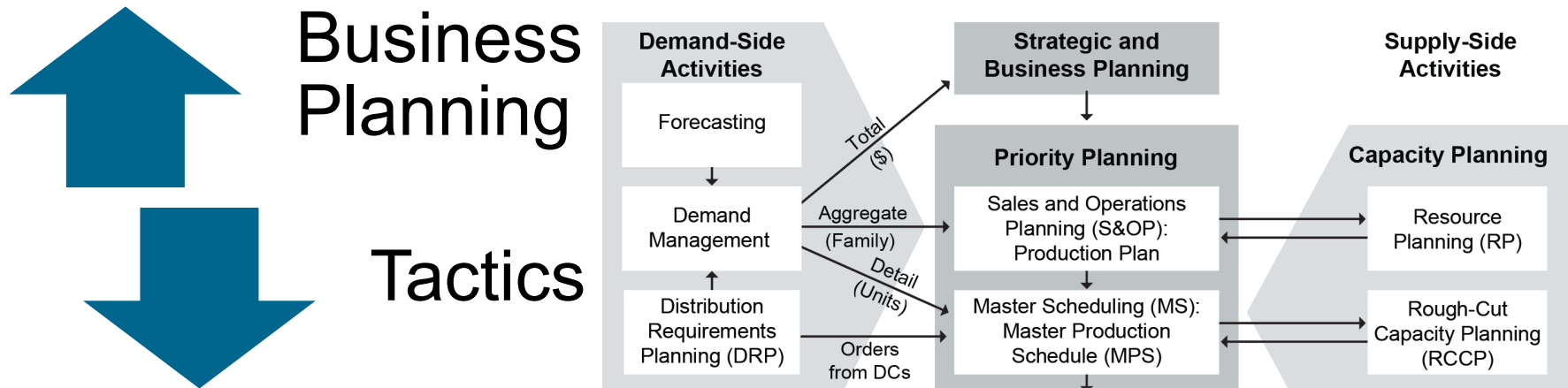
Reconciliation: Executive Meeting

- 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.

Sales and Operations Planning

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.



Sales and Operations Planning

Contributions to S&OP: Cooperation Among...

Demand Side

- Demand forecasts
- Demand plan commitments
- Demand plan numbers and assumptions
- Market analysis

Finance

- Financial feasibility
- Fit with business plan

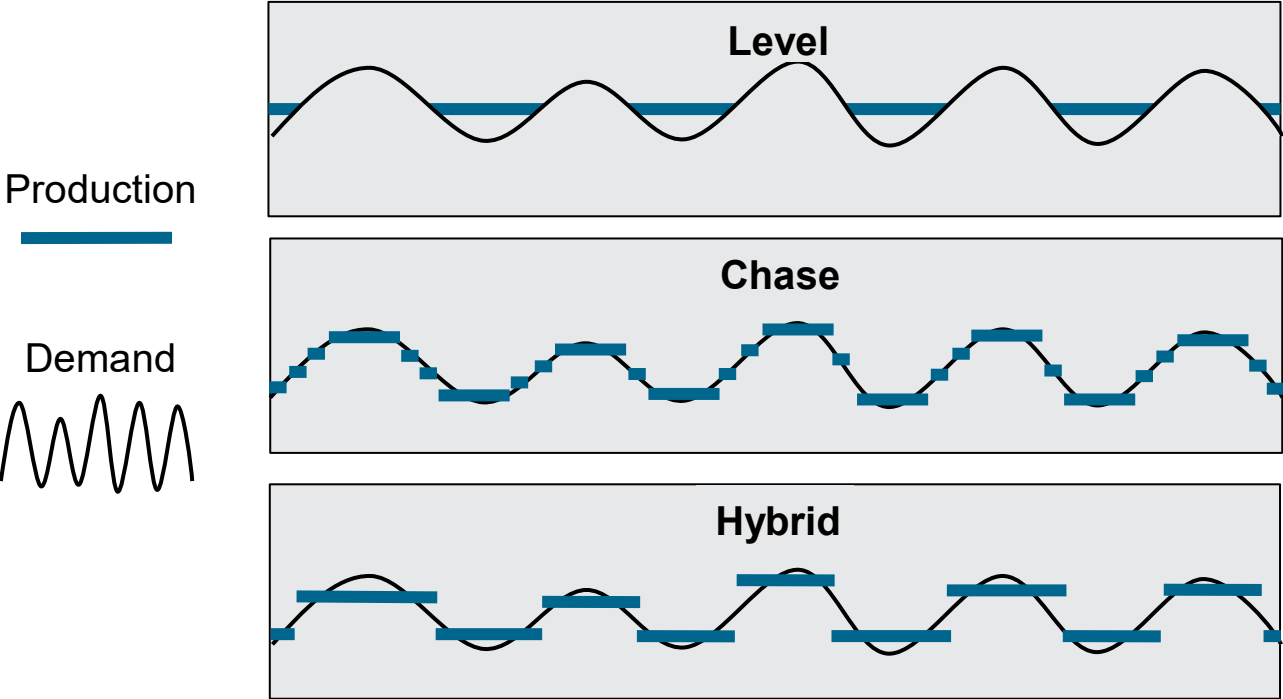
Supply Side

- Output and resources
- Product families
- Operations constraints
- Operations strategies
- Supply-demand strategies
- Actual results and other performance metric data



Sales and Operations Planning

Operations Strategies



Supply-Demand Strategies

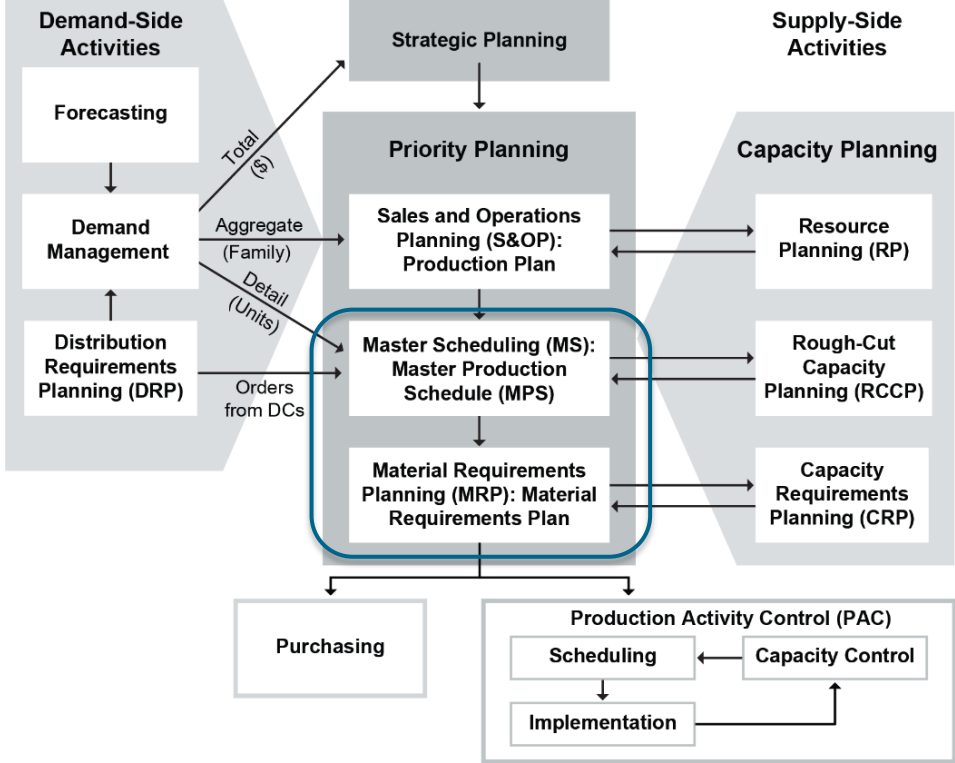
Allocation:

- 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) <ul style="list-style-type: none">• Few items made from many components• Integral design	Schedule finished goods.
Make-to-order (MTO) <ul style="list-style-type: none">• Many items made from few components• Custom	Schedule raw materials.
Assemble-to-order (ATO) <ul style="list-style-type: none">• Many end items, few components• Assemble near point-of-sale	Schedule module production.

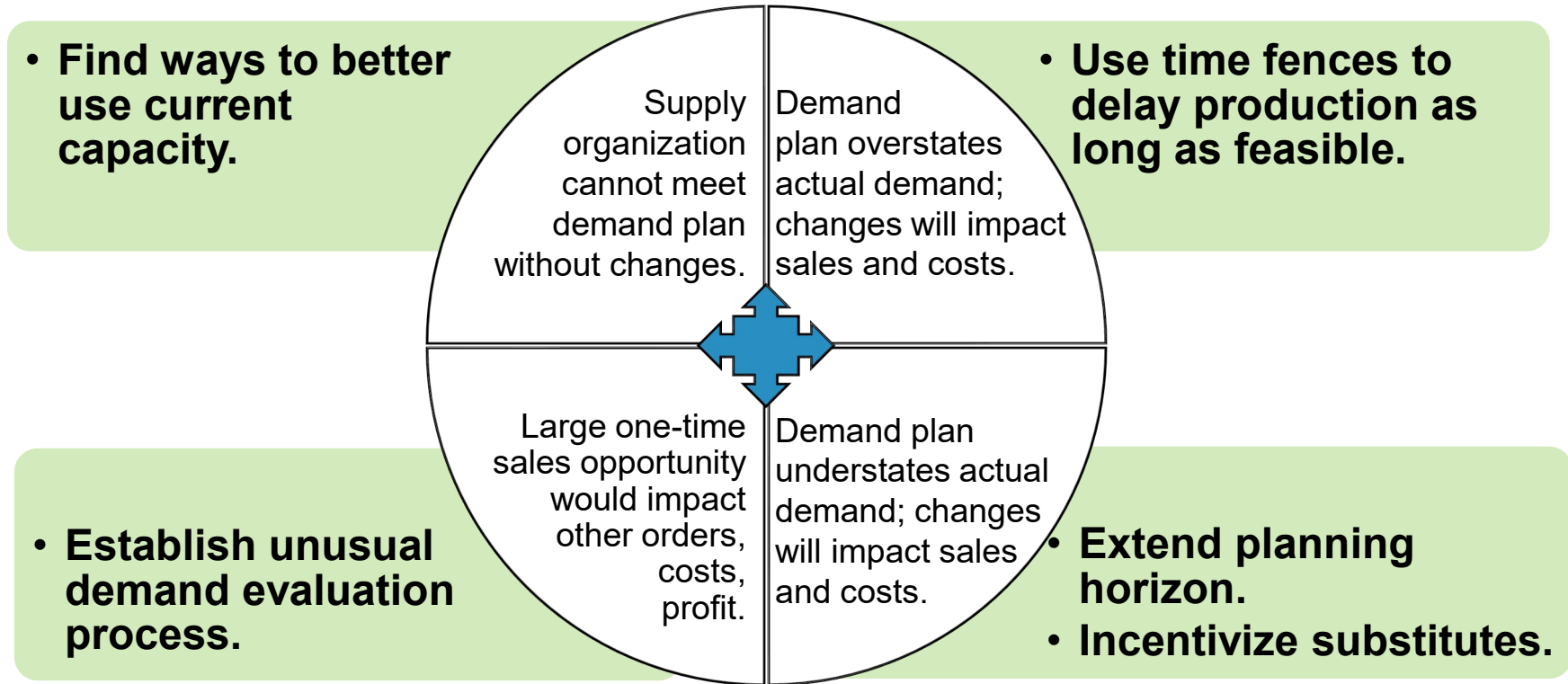
Sales and Operations Planning

Demand Management and Prioritization: MPS and MRP



Sales and Operations Planning

Situations for Managing and Prioritizing Demand



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