
Demand Forecasting, Planning, and Management

**Lecture to 2007 MLOG Class
September 27, 2006**

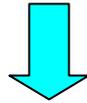
**Larry Lapide, Ph.D.
Research Director, MIT-CTL**



What Are Demand Forecasting, Planning, and Management?

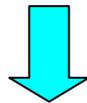
*What should we do to
shape and create demand?*

Demand Planning



*What will demand be for a
given demand plan?*

Demand Forecasting



*How do we prepare for
and act on demand when
it comes in?*

Demand Management

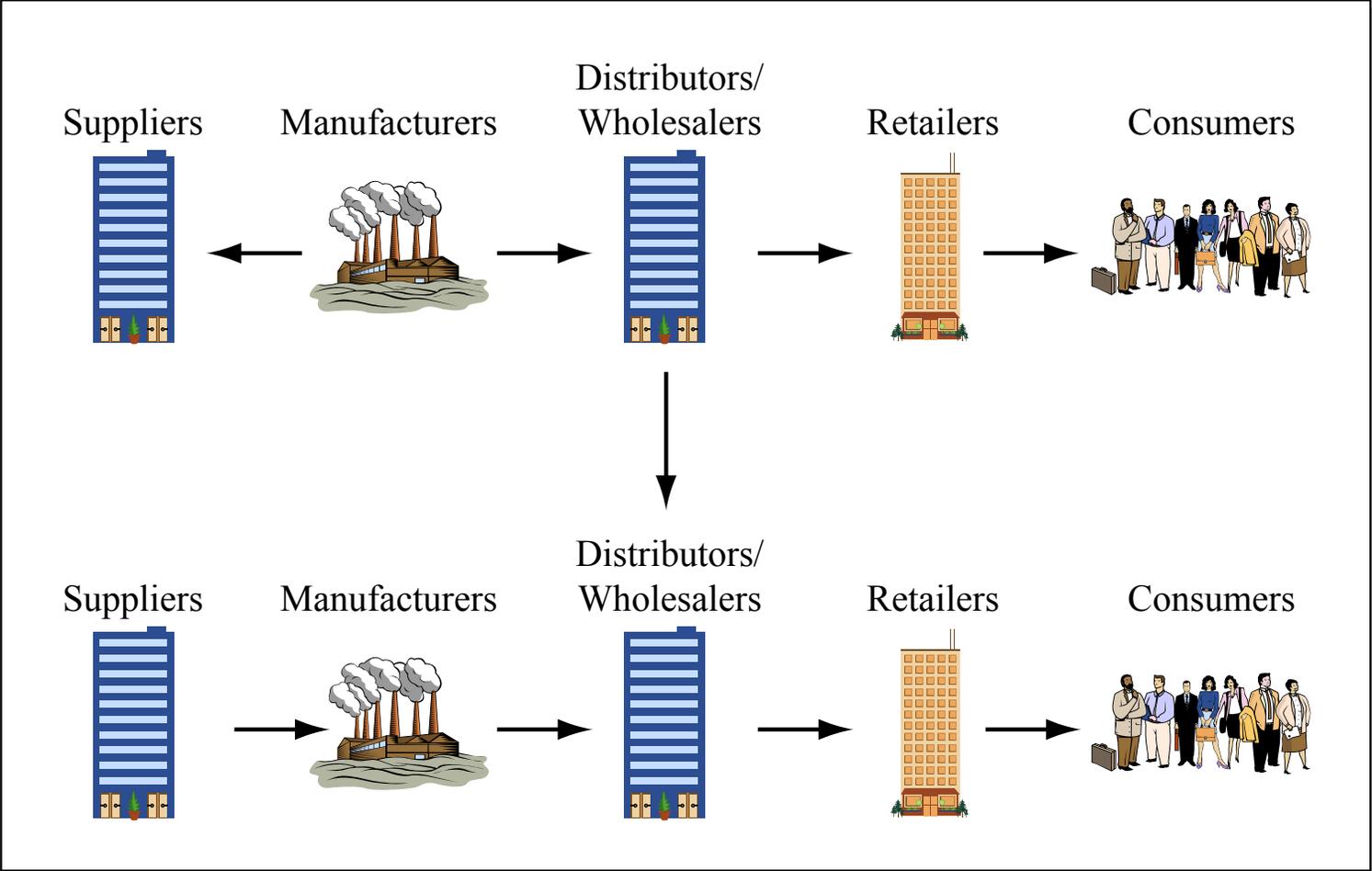


Agenda

- **Industry Trends**
- **Demand forecasting**
 - **Process**
 - **Methods**
- **Demand planning (with supply in mind)**
- **Demand management**



Industry Trends – Movement From Push to Pull Manufacturing



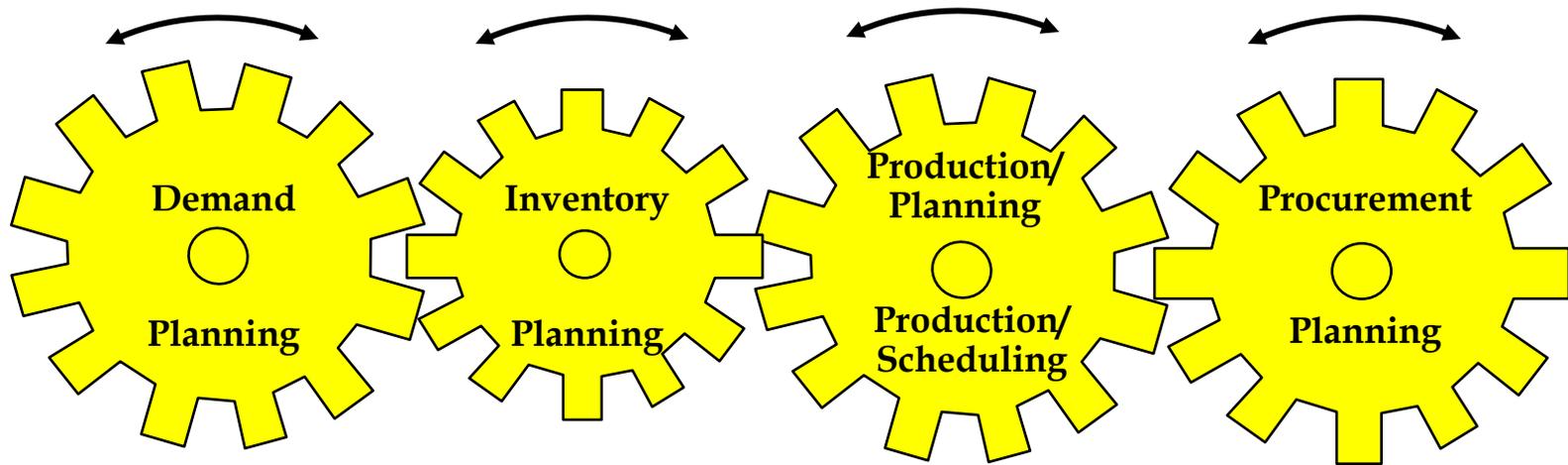
Make what we will sell, not sell what we make!

Figure by MIT OCW.



Now Moving to Demand-Driven and “Commercialized” Supply Chains

Aligning supply and demand plans to help ensure optimized profitability



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A Business Needs a Forecast of What Might Happen, Not Just a Real-time View

Image from comic strip removed due to copyright restrictions.



Why Do Companies Need to Forecast?

Demand forecasting supports corporate-wide planning activities

<i>Level of Forecast</i>	<i>Purposes</i>	
Strategic(years)	Business planning Capacity planning	
Tactical (quarterly)	Brand plans Financial planning/budgeting Sales planning Manpower planning	} <i>Operational Forecasts</i>
Tactical (months/weeks)	Short-term capacity planning Master planning Inventory planning	
Operational(days/hours)	Transportation planning Production scheduling Inventory deployment	



Forecasting Process: Four Success Factors

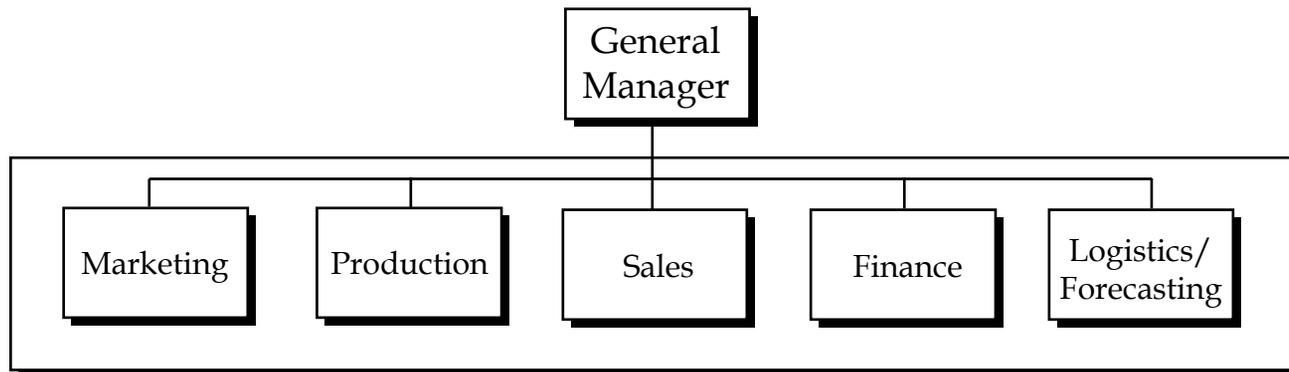
1. An integrated forecast organization
2. “Single number” forecasting process
3. Part of a Sales and Operations Planning (S&OP) process
4. Performance measurements



1. Forecasting Organization

A integrated approach is driven by a stakeholder organization that is chartered with driving commitment and accountability to “single number” consensus-based forecasts

Integrated Approach



- Forecast administration driven by a stakeholder
- Stakeholder responsible for getting input from others
- Responsible for driving to a reconciled consensus forecast
- Less important which function is stakeholder, but usually marketing or operations



1. Forecasting Organization: Where Function Resides

Where the Forecasting Function Resides*:

- Operations/Production: 26%
- Sales: 17%
- Marketing: 13%
- Logistics: 12%
- Strategic Planning: 12%
- Forecasting Dept: 8%
- Others: 8%
- Finance: 5%

*Source: C. Jain, “Benchmarking Forecasting Practices in Corporate America”, JBF, Winter 2005-06



1. Forecasting Organization: Where Function Resides

SUMMARY OF PROS AND CONS OF PUTTING THE FORECASTING FUNCTION IN EACH TYPE OF DEPARTMENT

Department	Objectivity	Business Understanding	Quantitative Skills	Organizational Skills
Standalone Forecasting	Objective, but not impacted by demand	No direct contact with customers	High Level	High level of discipline
Marketing	Objective, but some bias from performance goals	Very good understanding of future customer needs	Low Level	Moderate level of discipline
Production, Operations and Logistics	Objective and impacted by demand	Little direct contact with customers	High Level	High level of discipline
Sales	Bias from sales goals and commissions	Highest level of contact with customers	Low Level	Less interest in running structured, routine processes
Finance	Objective, but some bias from budgeting and not impacted by demand	No direct contact with customers	High Level	High level of discipline
Strategic Planning	Objective, but not impacted by demand and view is too long-term	No direct contact with customers	High Level	High level of discipline

Figure by MIT OCW.



1. Forecasting Organization: Skills and Tasks*

- Skills needed
 - Quantitative
 - Computer
 - Oral communications
 - Understanding of the business
 - Process management

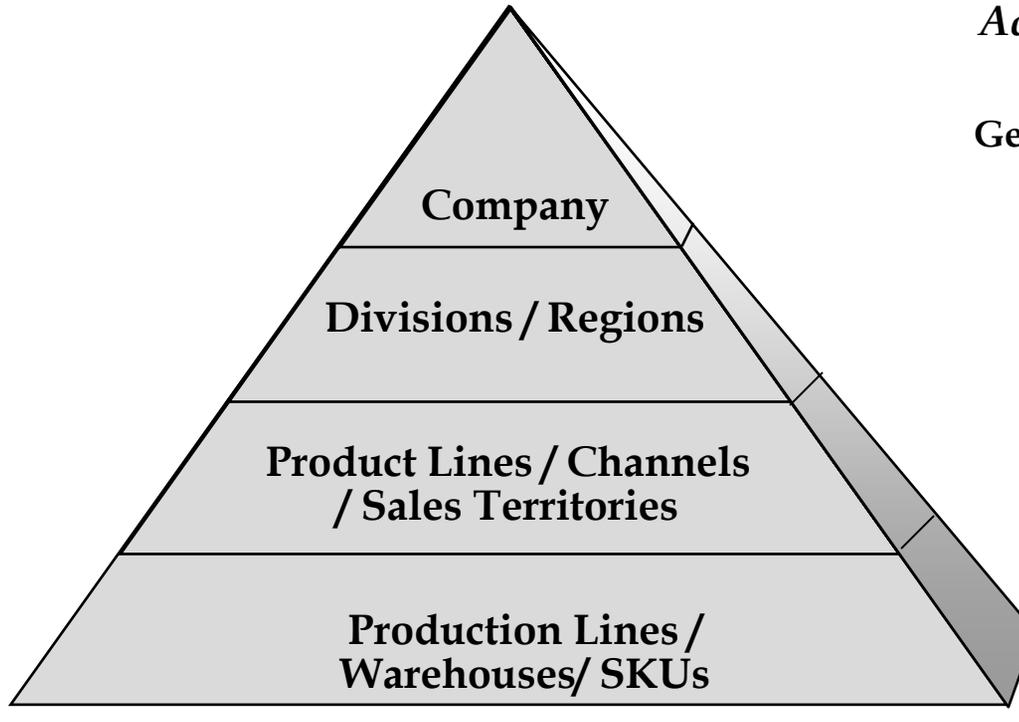
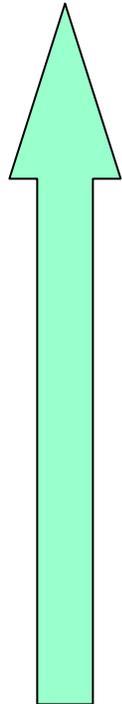
- Dividing up the work by
 - Sales channels
 - Product lines or brands
 - Geographies
 - Skill sets

*Source: L. Lapide, “Organizing the Forecasting Department”, JBF, Summer 2003



2. Single Number Forecasting Process: Manufacturer

*One Number
Forecast/Plan*



Accountability/Commitment

General Manager/CEO/CFO

Divisional GMs/Presidents

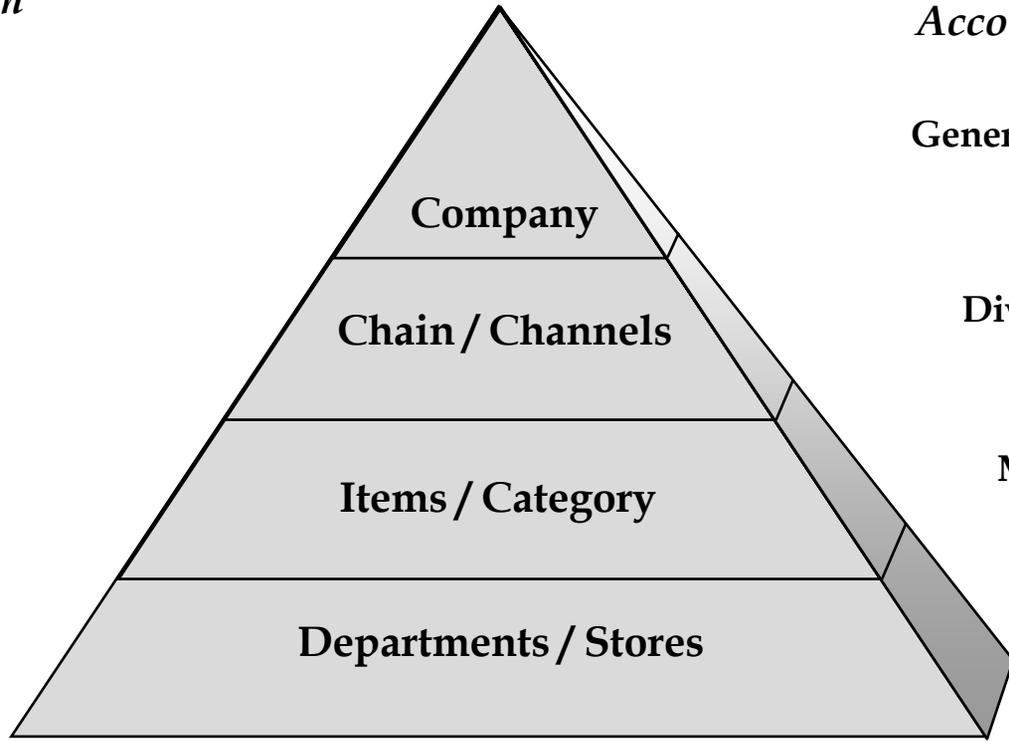
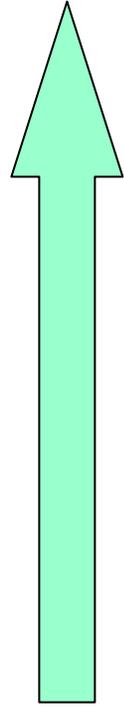
Marketing/Sales

Operations/Logistics



2. Single Number Forecasting Process: Retailer

*One Number
Forecast/Plan*



Accountability/Commitment

General Manager/CEO/CFO

Divisional GMs/Presidents

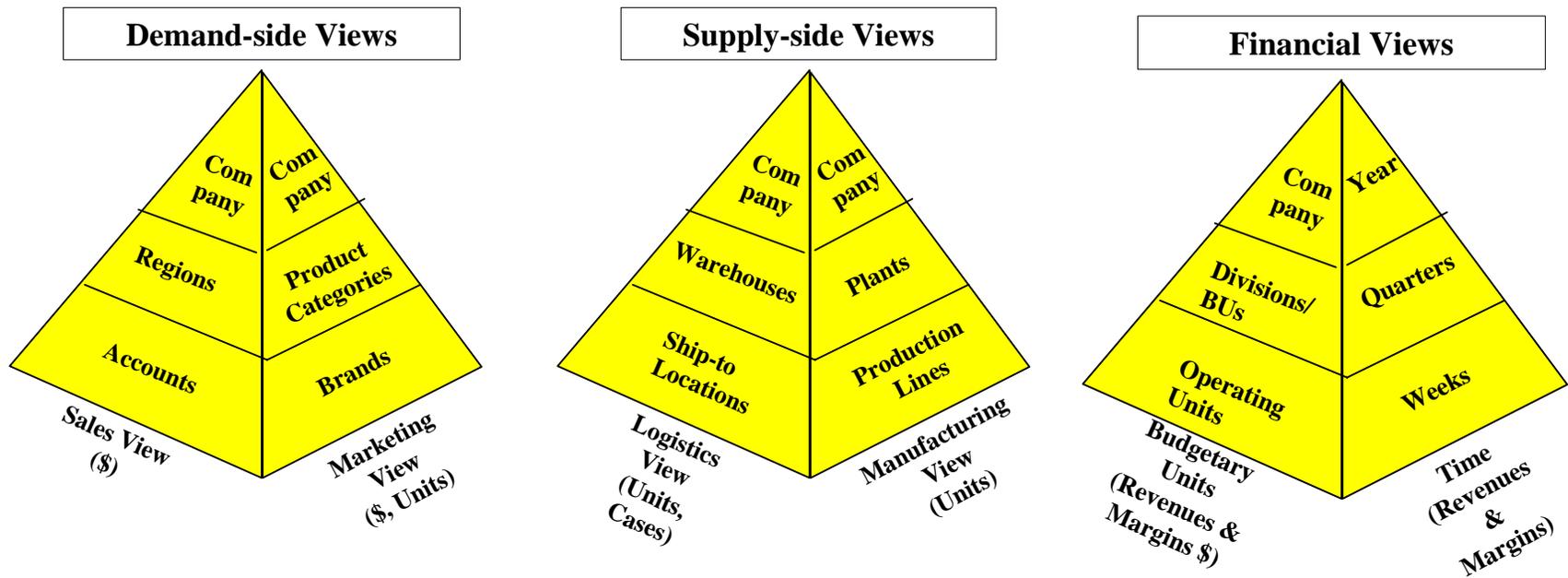
Merchandisers / Buyers

Store Operations

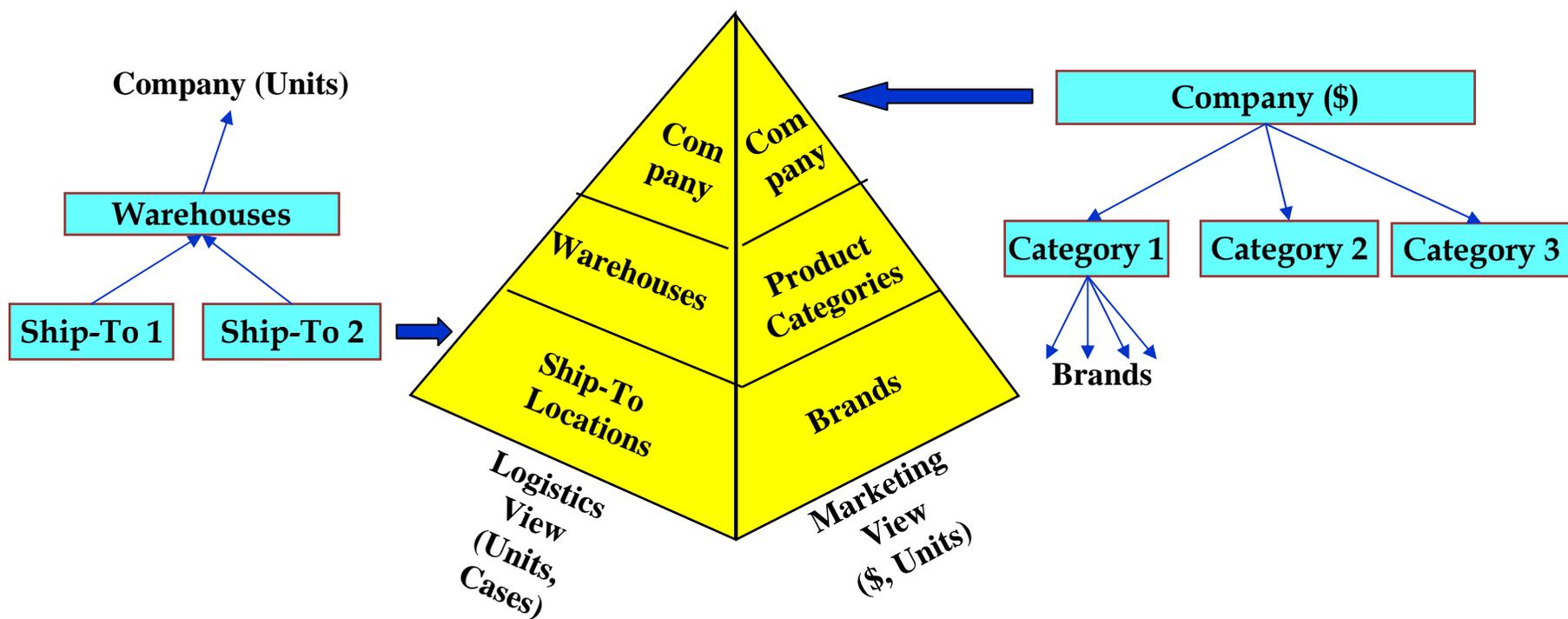


2. Single Number Forecasting Process: Forecasting & Planning Hierarchies

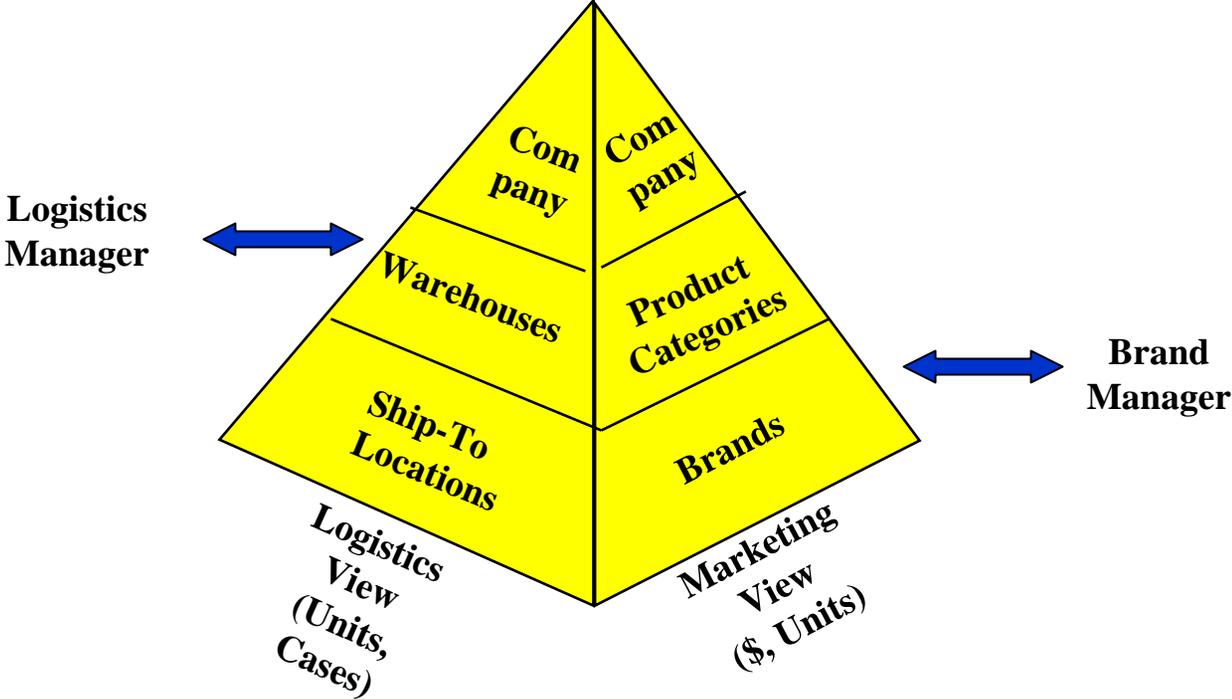
Single number forecasts/plans need to be translated into terms stakeholders can understand



2. A Hierarchy Is Leveraged By Top-Down and Bottom-Up Forecasting in Baseline Forecasting

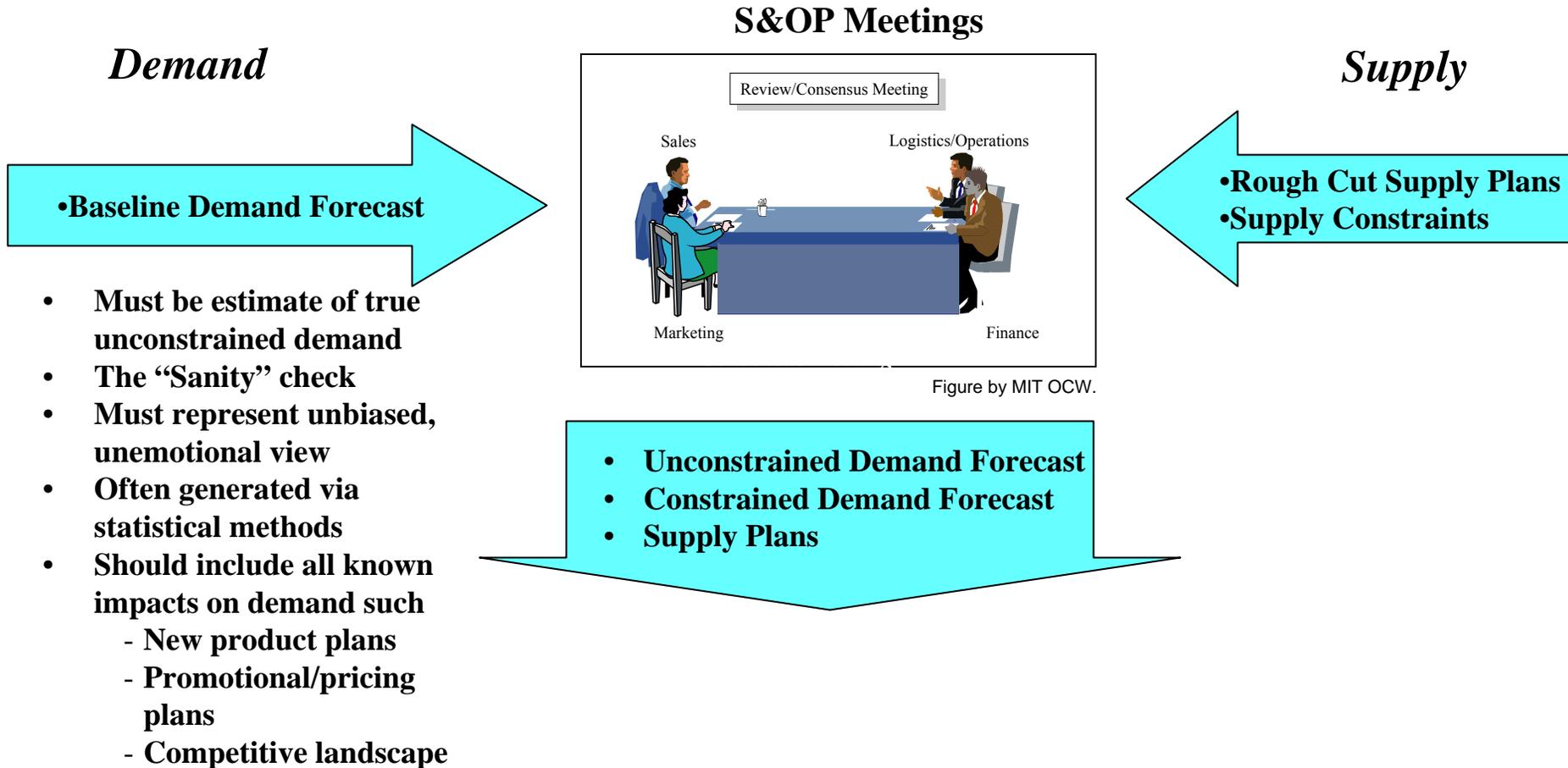


2. The Hierarchy is Also Leveraged When Incorporating Market Intelligence Into Forecasts/Plans



3. Part of an S&OP Process

An S&OP Process Is Driven by a Baseline Demand Forecast



3. Part of an S&OP Process: Elements of S&OP meetings

- Number of meetings
 - One: To match supply and demand
 - Three: Demand, then supply, then final executive-level adjustments
- Frequency and length
 - Monthly or weekly
 - 2 hours to half of a day
- Cross-functional
 - Demand forecasting organization
 - Supply chain
 - Operations (e.g., manufacturing, logistics)
 - Marketing
 - Sales
 - Finance



3. Part of an S&OP Process: Success Factors

1. Ongoing routine S&OP meetings
2. Structured meeting agendas
3. Pre-work to support meeting inputs
4. An unbiased baseline forecast to start the process
5. Cross-functional participation
6. Participants empowered to make decisions
7. An unbiased, responsible organization to run a disciplined process
8. Internal collaborative process leading to accountability/consensus



4. Performance Measurements

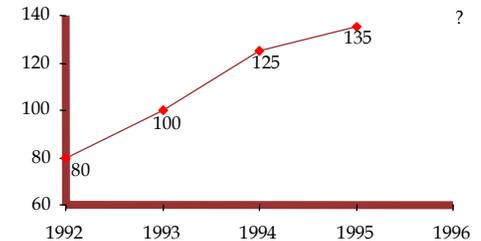
Demand Forecasting Needs Process-based Performance Metrics
(e.g., KPIs)

- Forecast accuracy
- Variance to baseline forecast
- Forecast versus budget
- Adherence to demand plan (i.e., sales and marketing plan)

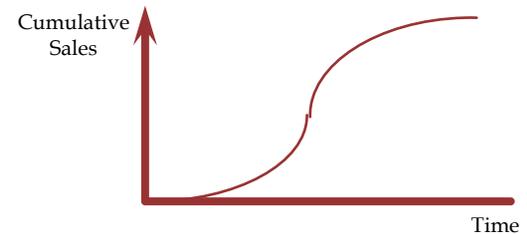


Forecasting Methods

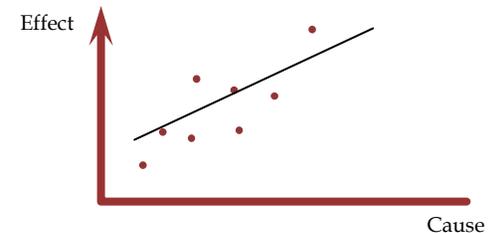
Times Series → Uses prior history to project



Life Cycle → Uses the sales curve of similar products or product lines



Cause-Effect → Uses cause-effect relationships, uses forecast of cause to predict effect

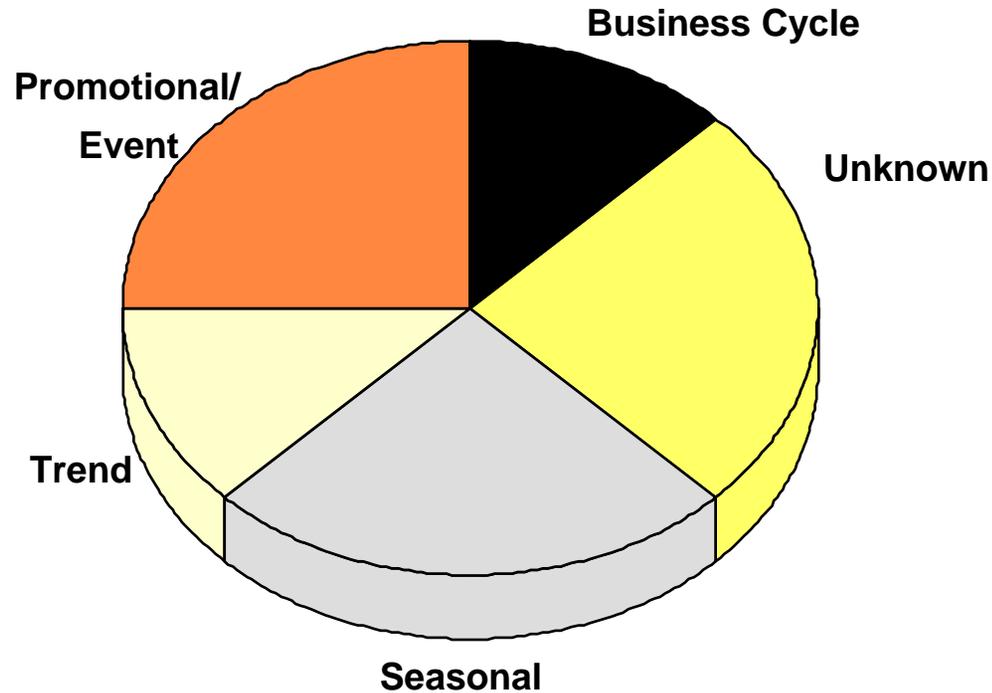


Judgmental → Uses opinion-based information



Forecasting Methods

Forecasters need to understand demand variation



**Percent of Demand Variation Analysis
(Components of Demand Variation)**



Forecasting Methods

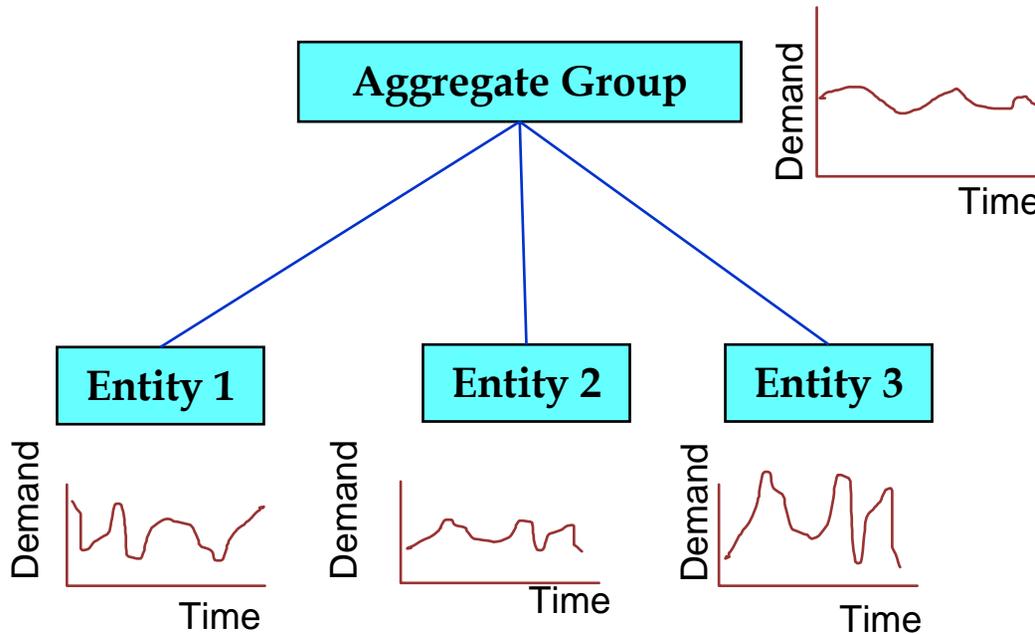
Product lines need to be segmented to help identify the types of forecasting methods needed

Product Segment	Common Methods
New products	<ul style="list-style-type: none">• Life cycle
Mature products	<ul style="list-style-type: none">• Time series (with trend and seasonality)
Promoted and event-based products	<ul style="list-style-type: none">• Time series• Event, cause-effect
Slow-moving or sporadic	<ul style="list-style-type: none">• Croston's• Poisson
Kits and subassemblies	<ul style="list-style-type: none">• Parent-child relationships• Planning bills
Cannibalized	<ul style="list-style-type: none">• Dependent• Life cycle



Bottom-Up and Top-Down Forecasting

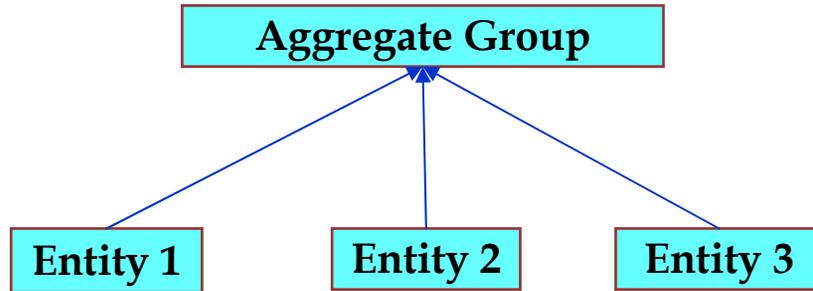
Aggregated product demand is less variable than individual demands,



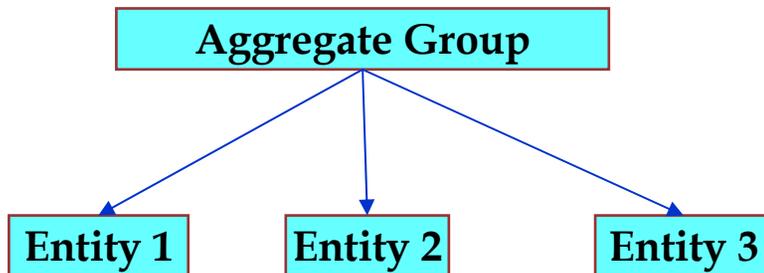
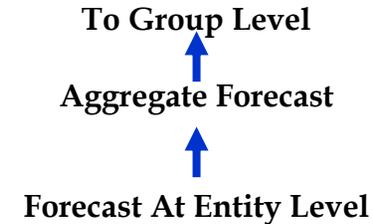
... so a forecast of the aggregate is more accurate than individual forecasts aggregated



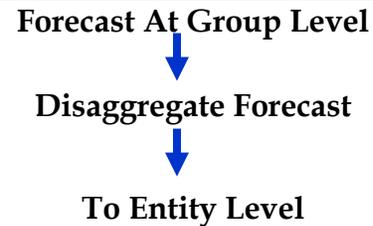
Bottom-Up and Top-Down Forecasting



BOTTOM-UP FORECASTING

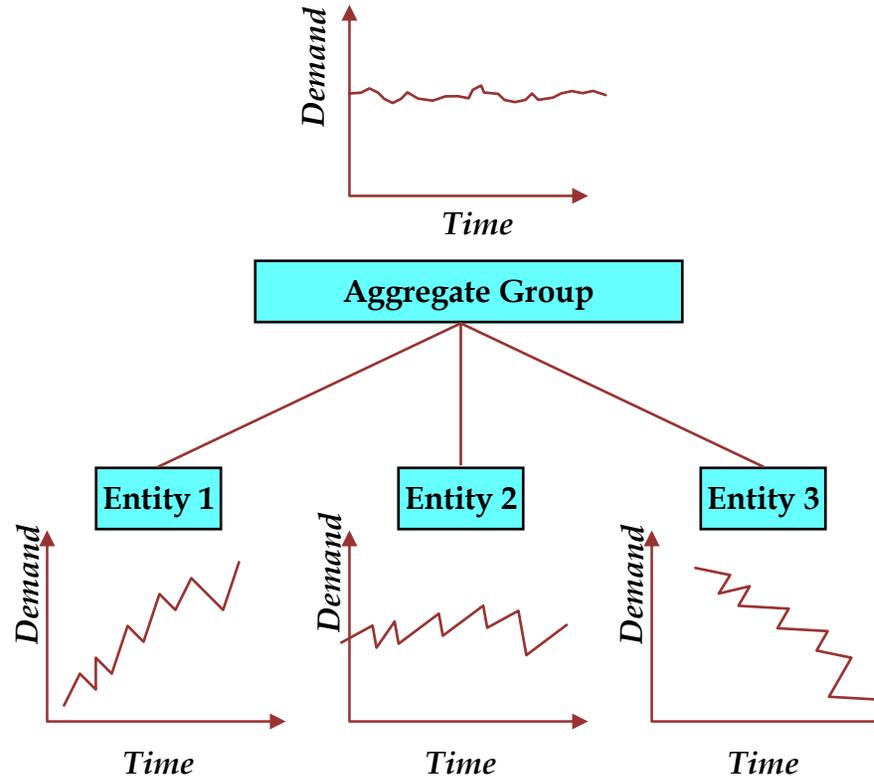


TOP-DOWN FORECASTING



Bottom-Up and Top-Down Forecasting

However, top-down does not always work

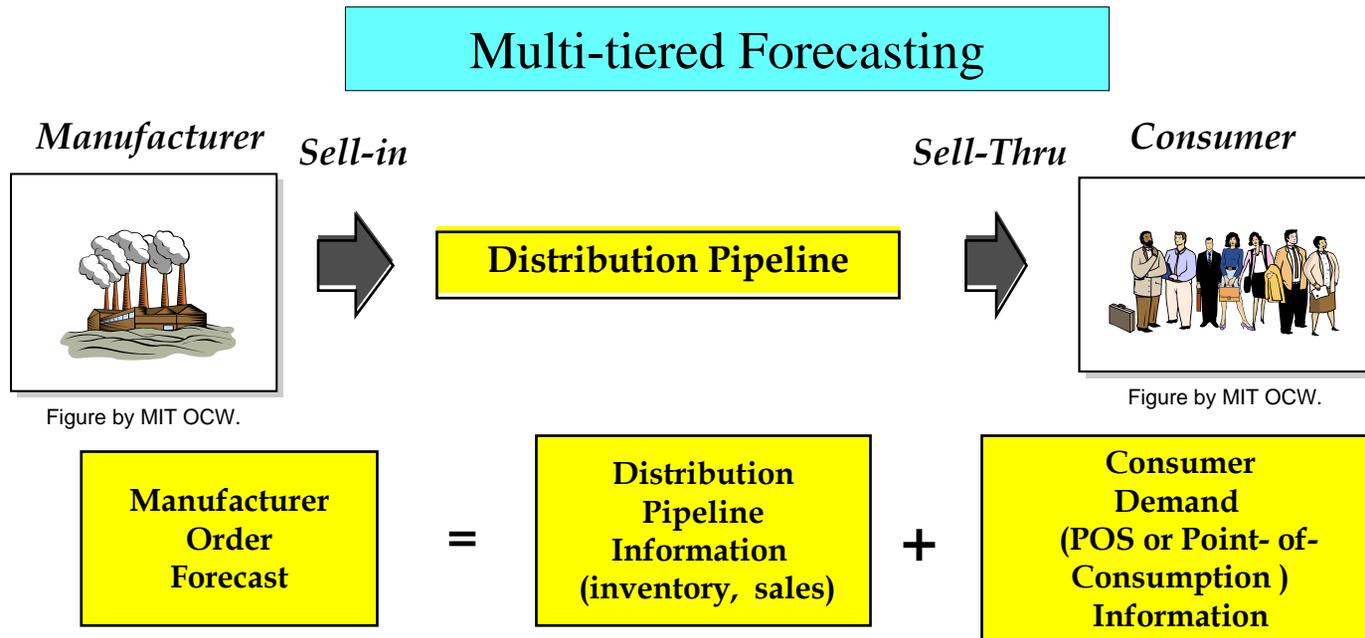


... so bottom-up followed by top-down and middle-out is often best



Forecasting Methods

Multi-tier Forecasting Methods Make Use of POS/ Consumption and Other Downstream Information



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Demand Planning (with supply in mind)

The 4P's of marketing:

- Product decisions - packaging and sizes
- Pricing decisions - list and discounts
- Promotional decisions - consumer and trade
- Place – distribution and sales channels

While demand plans are developed by Marketing and Sales, they should be made in the context of supply-side planning



Demand Planning (with supply in mind)

Supply-side issues to consider when demand planning

- Supply feasibility of demand plan
- “True” profitability analysis of demand plan
- Supply-opportunity based plans – e.g., excess inventories or plant capacity
- Jointly optimized supply and demand plan



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Demand Management Processes Bridge Supply and Demand-Side Management To Optimize Decision-Making

Supply-Side Management

Suppliers

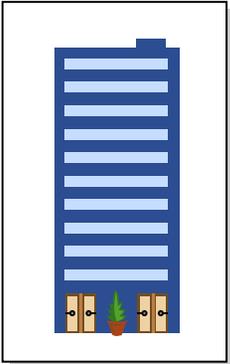


Figure by MIT OCW.

- Operations
- Logistics
- Supply Chain
- Merchandize Planning
- Procurement
- Finance

Minimize costs and inventories

DM Processes

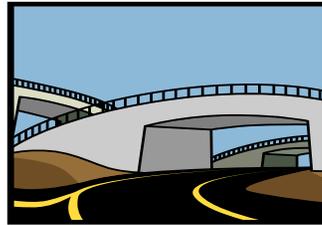


Figure by MIT OCW.

Matching supply and demand

- Long Term
- Medium term
- Short Term

Maximize sustained profitability

Demand-Side Management

Customers



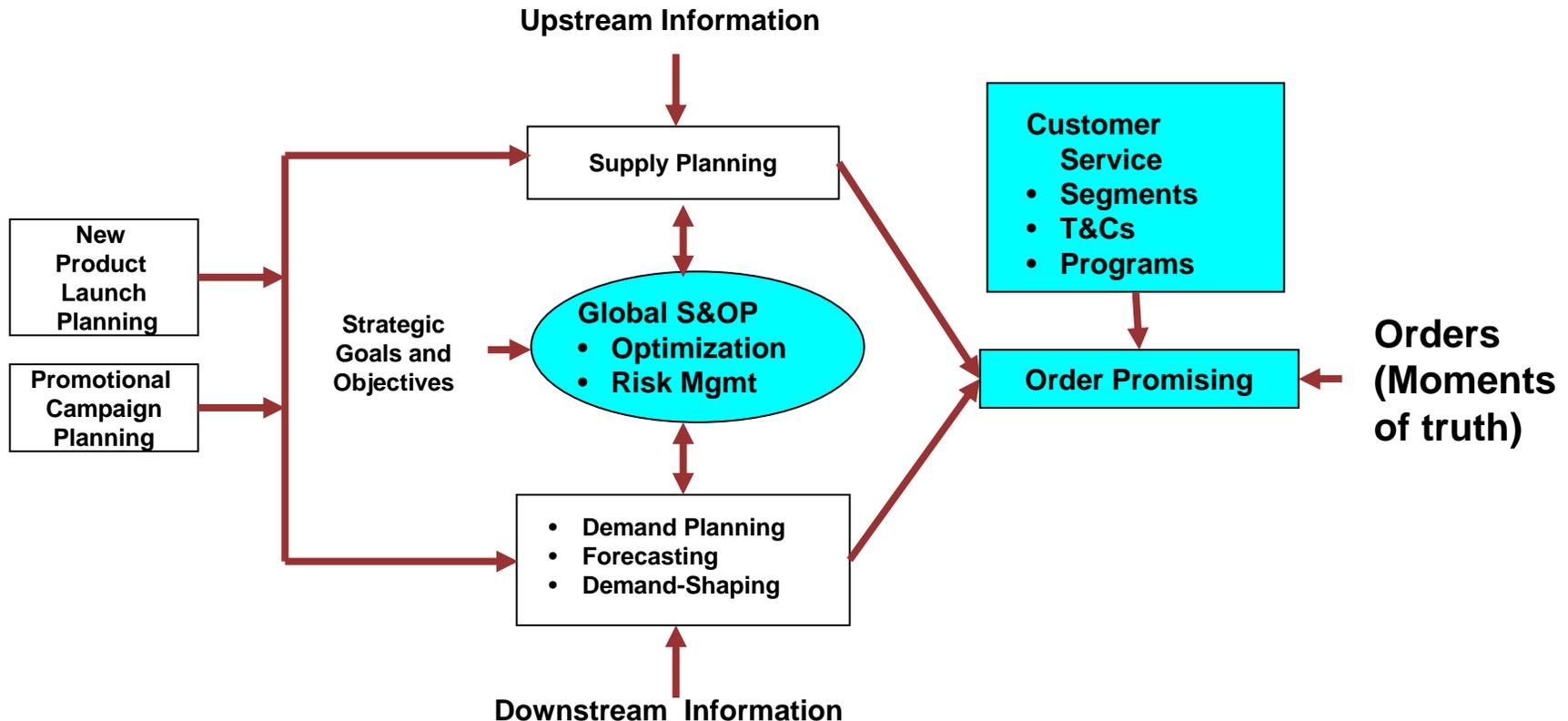
Figure by MIT OCW.

- Marketing
- Sales
- Merchandizing
- Customer Service

Maximize revenues and margins



Demand Management Process Scope

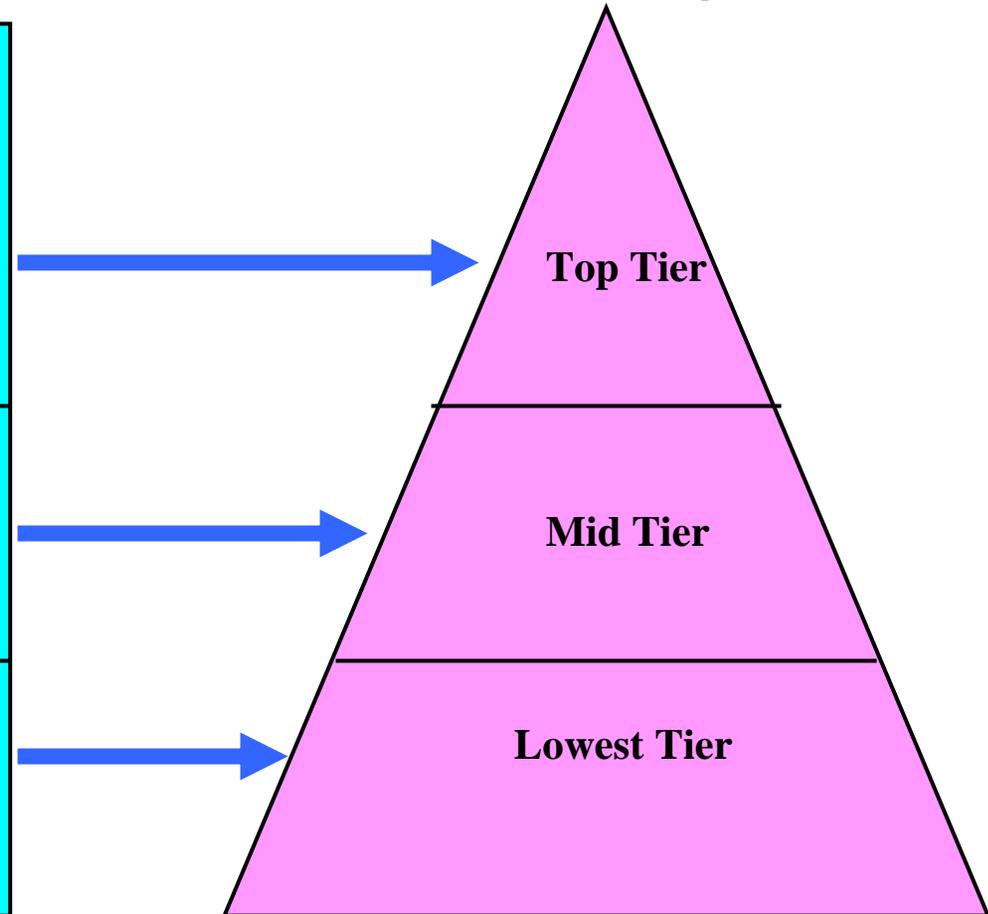


Service-Related Terms and Conditions and Programs Set Customer Expectations in the Long-Run

Differentiated Service Programs

High Tier Services <ul style="list-style-type: none">• Sharing of downstream data (e.g., POS)• Sharing of replenishment plans and sales forecasts• Co-managed inventory programs
Mid-Tier services <ul style="list-style-type: none">• Special handling and packaging• Reduced delivery cycles times• Full-truckload discounts
Basic Services <ul style="list-style-type: none">• Standard delivery cycle time• Standard handling and packaging

Customer Segments



Order Promising Needs to Address Complex Customer Demand Questions

- Do I fill this customer's order right now?
- If not now, when?
- Should I fill it using available or planned inventories?
- Should I fill it using available or future production capacity?
- Should I fill it using available or future materials?
- Is this customer's order more important than another customer's future order?
- Is this customer order more important than a warehouse or plant replenishment order?
- If I take the order, at what price?



The Importance of Order Promising

– Accurate Order Promising

- Insures making a promise you can keep
- Reduces expediting costs
- Increases customer satisfaction

– MIT survey on Order Promising shows (% of companies)

- 11% do not promise at the time of an order
- 49% use a standard lead time list
- 42% check available inventory (Available-to-Order, ATP)
- 24% check production schedules (ATP)
- 14% check available production capacity, parts and materials (Capable-to-Order, CTP)



Questions?

