SMARTLOG - workshop

June 8, 9, 2005

Optimizing the Supply Chain

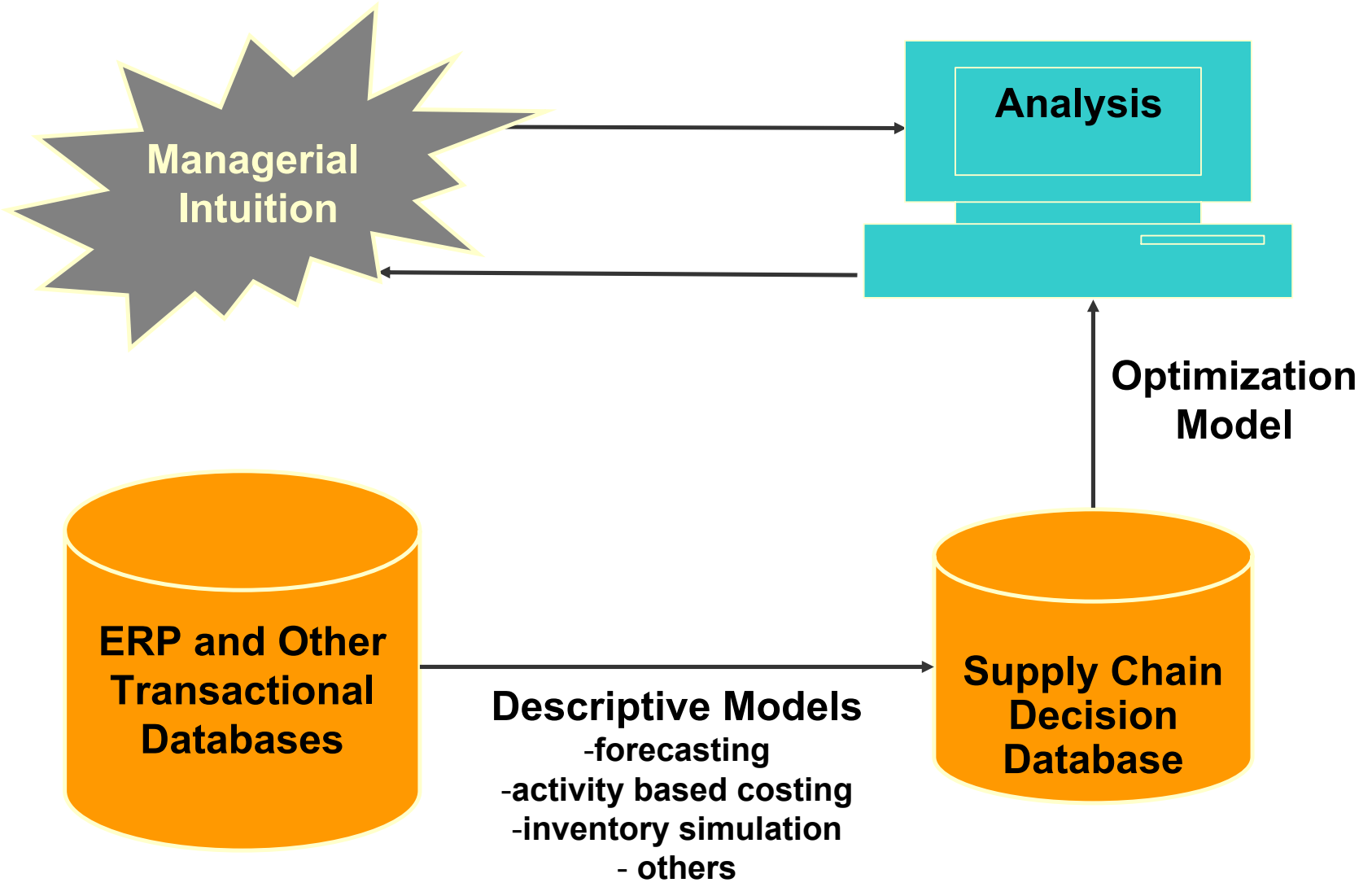
Session 1

Jeremy F. Shapiro

MIT/Slim Technologies

Theme

- How to Use
  - Data
  - Models
  - Modeling Systems
- To Improve Supply Chain Management


Managerial Intuition
Analysis
Optimization Model
ERP and Other Transactional Databases
Descriptive Models
-forecasting
-activity based costing
-inventory simulation
- others
Supply Chain Decision Database

Optimization models can unravel the complex interactions and ripple effects that make supply chain planning problems difficult and important.

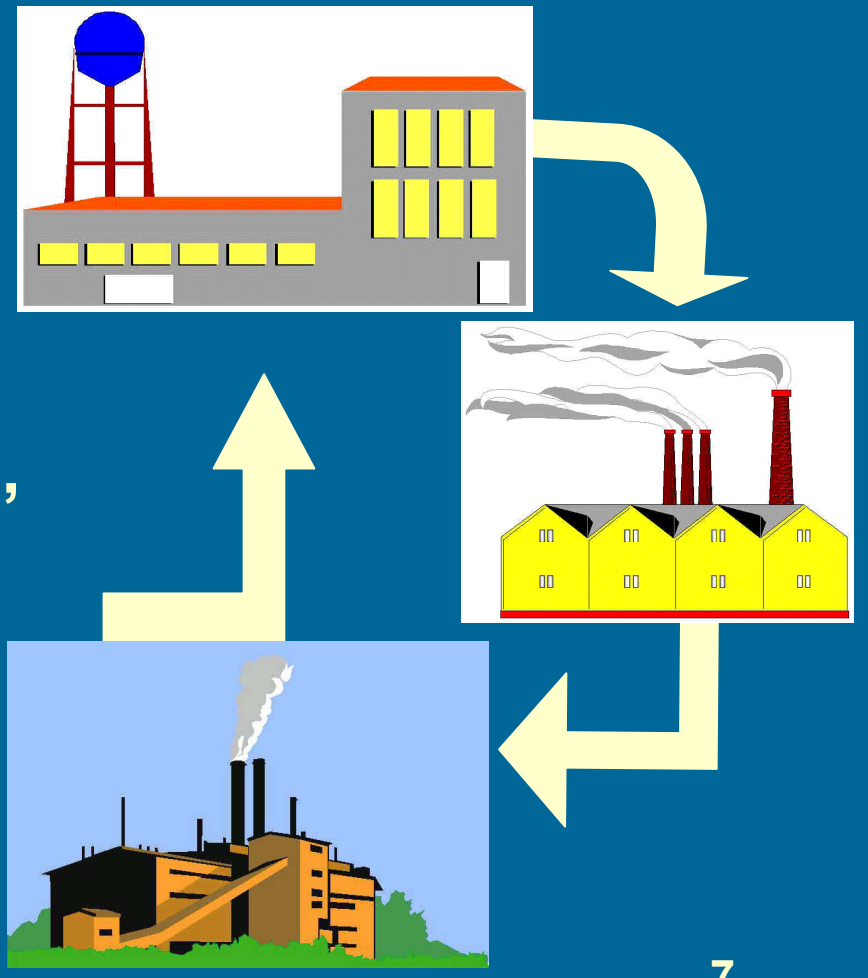
Agenda – Session 1

- Fundamentals of Supply Chain Management
- Objectives of Supply Chain Management
- DC Location Study
- Integrating Inventory Decisions with other Supply Chain Decisions

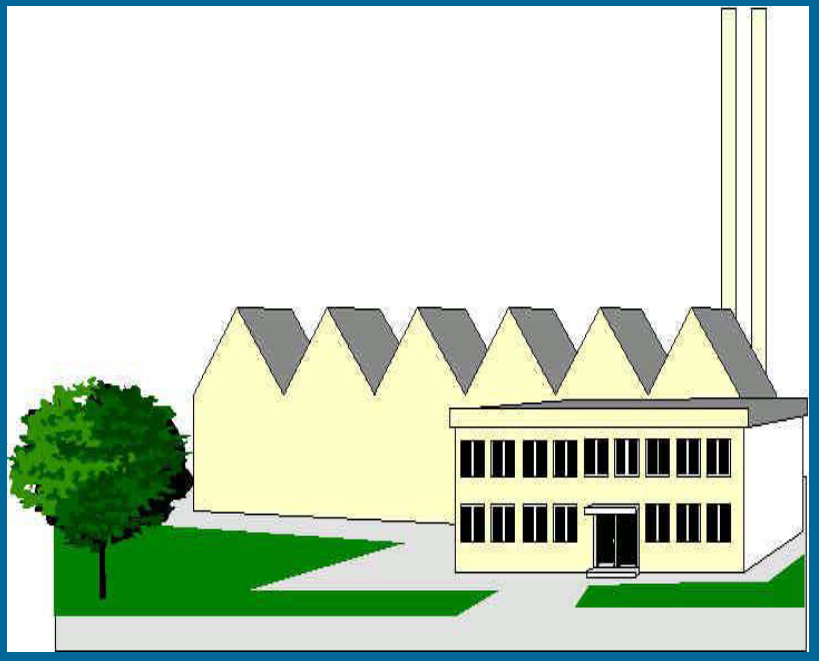
Fundamentals of Supply Chain Management

What is Supply Chain Management

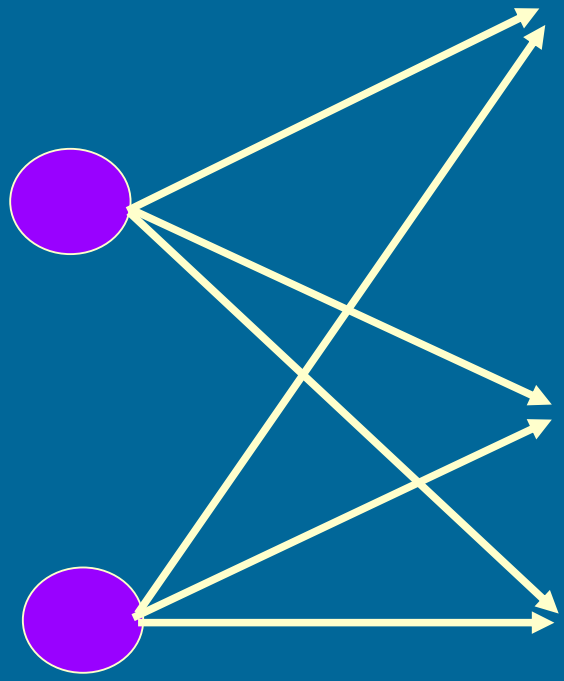
- A company's supply chain is comprised of geographically dispersed facilities where products are acquired, transformed, stored, or sold, and transportation links connecting facilities along which products flow.



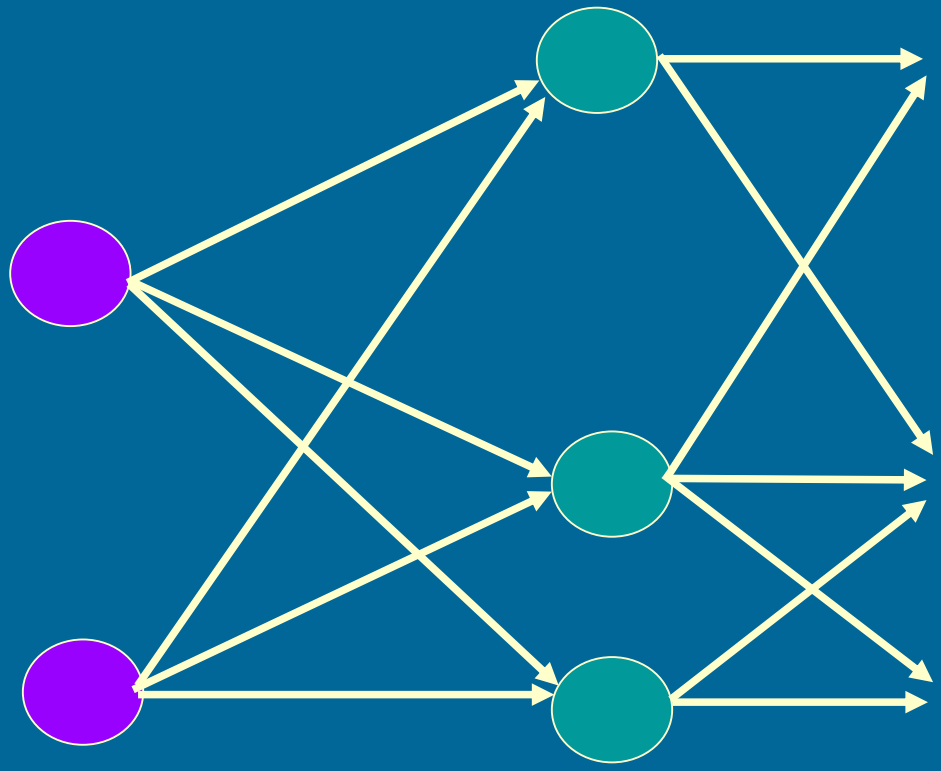
What is Supply Chain Management



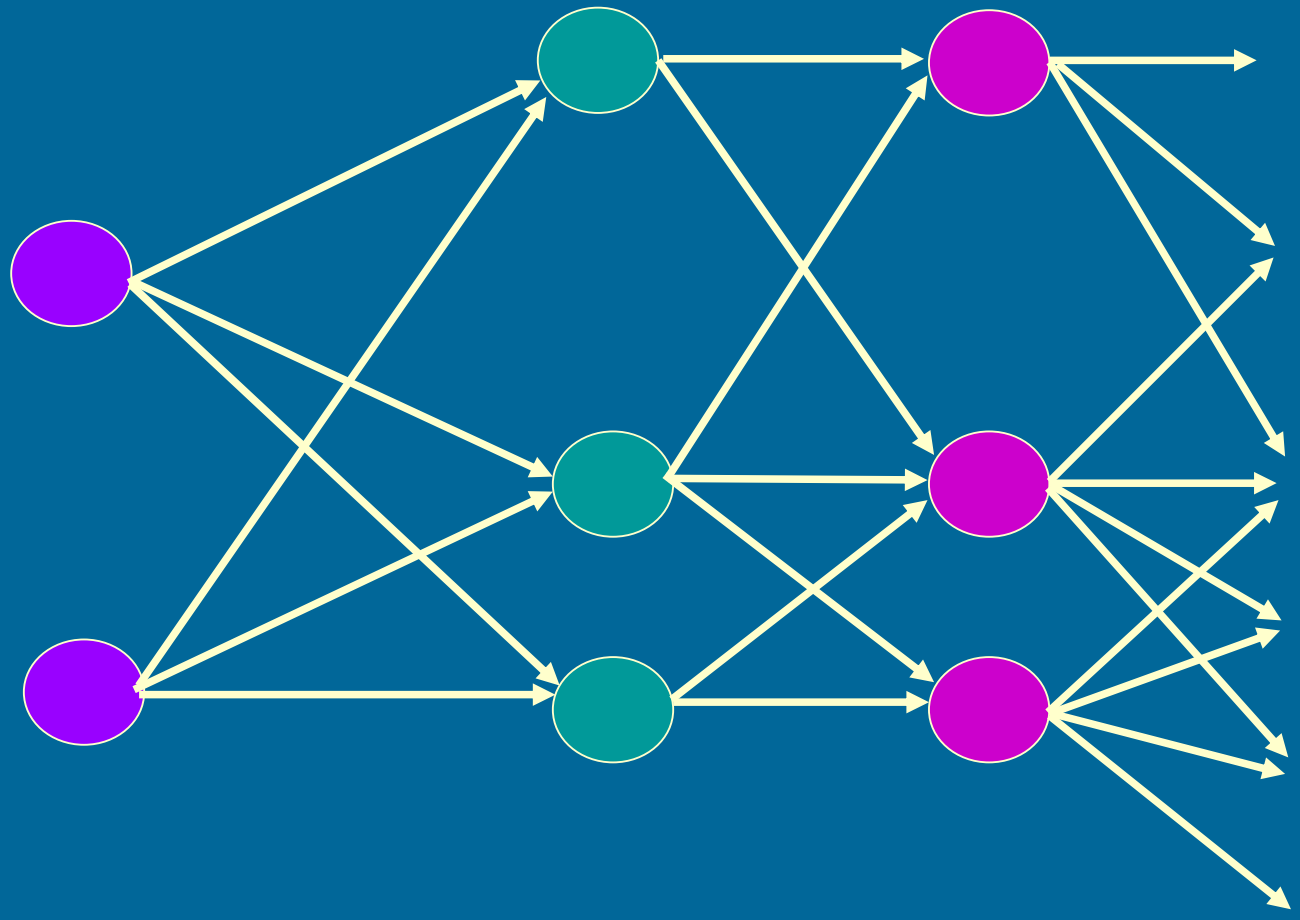
- The facilities may be owned and operated by the company, or they may be owned and operated by vendors, customers, or third-party providers.



Suppliers



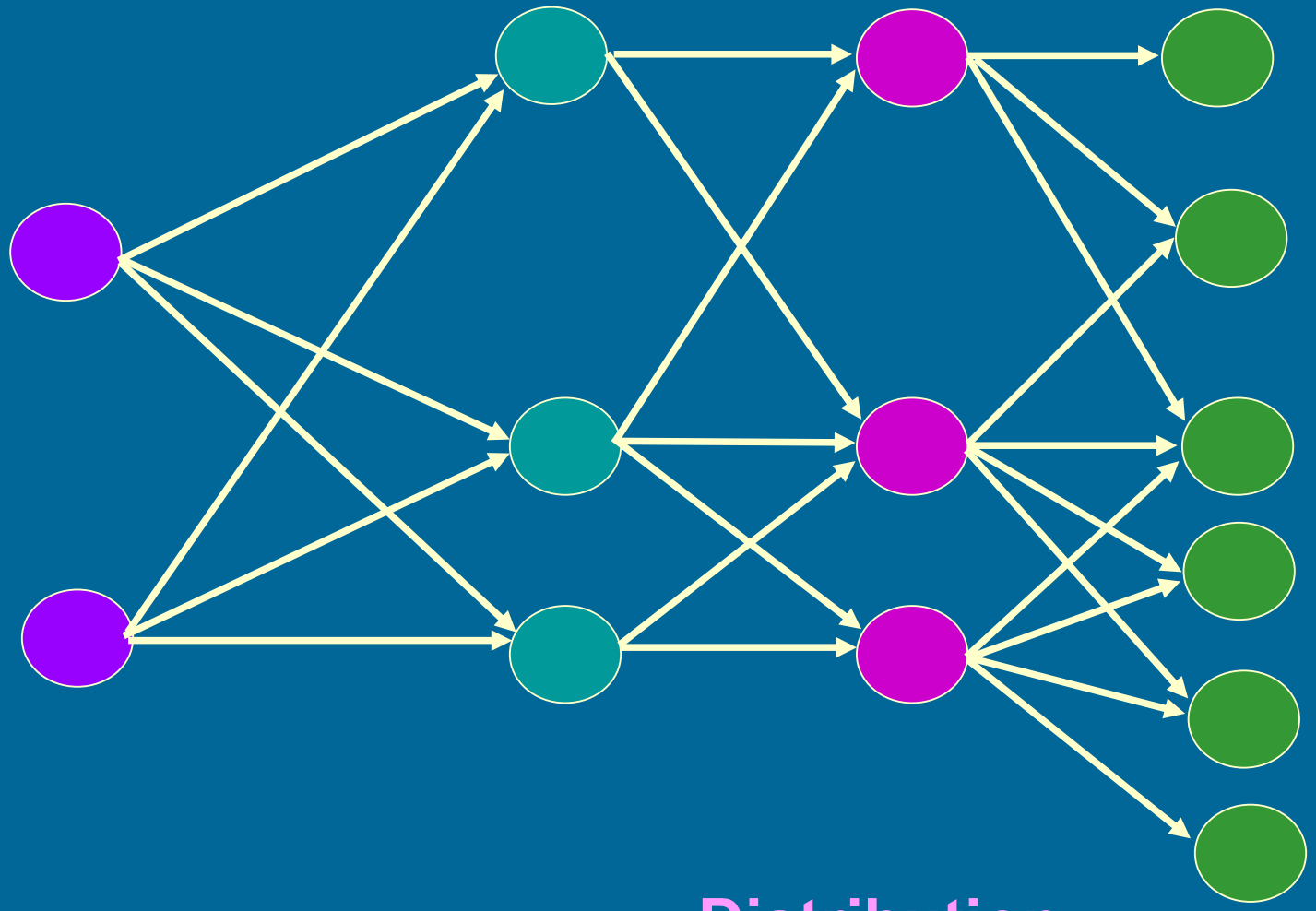
Suppliers Plants



Suppliers

Plants

Distribution Centers


Suppliers
Plants
Distribution Centers
Markets

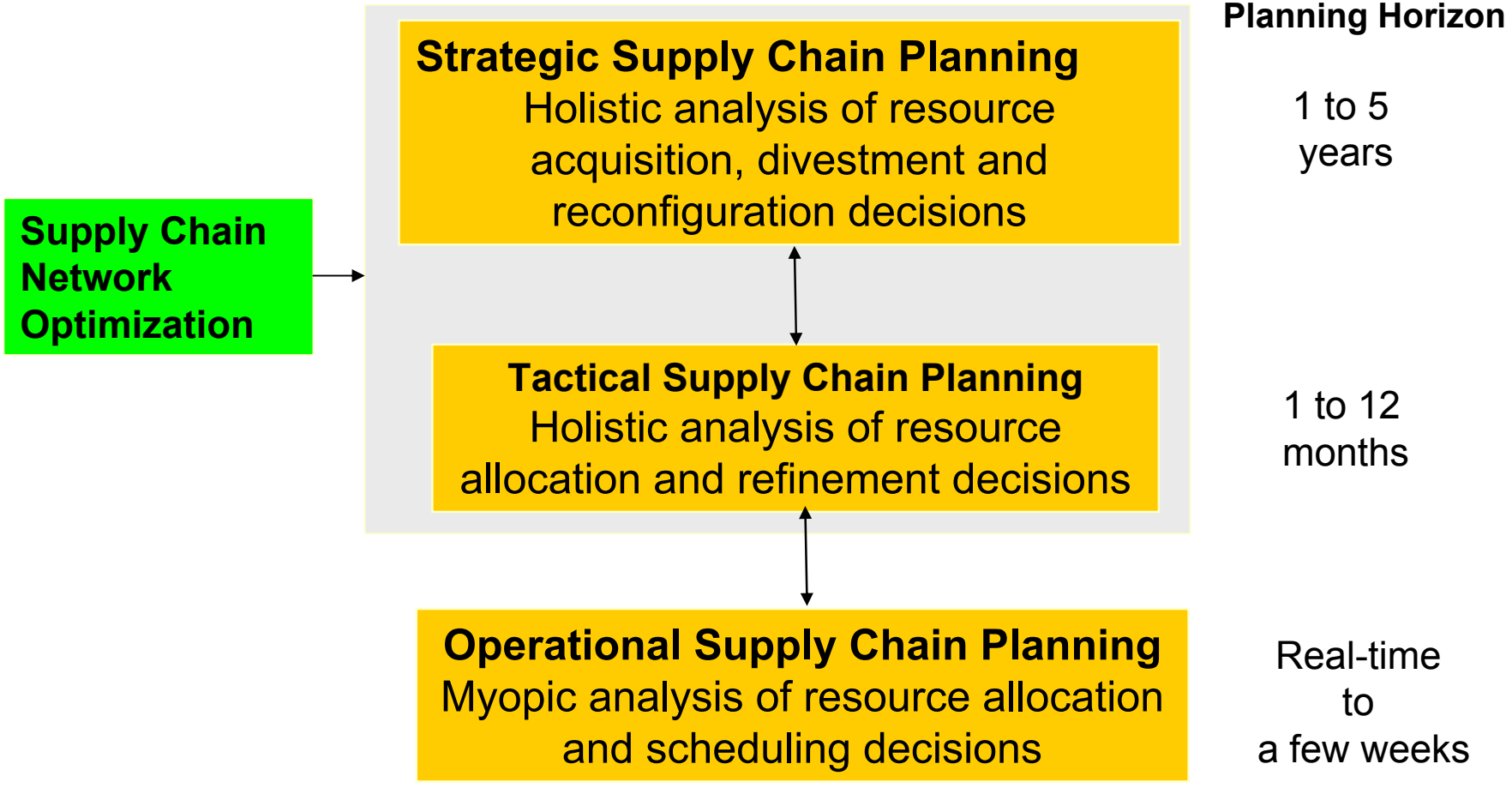
Supply Chain Management is Integrated Management

- Functional Integration of
  - Purchasing
  - Manufacturing
  - Transportation
  - Inventory Management
  - Warehousing Activities

- **Spatial Integration of Vendors, Plants, Distribution Centers, and Markets**

- **Inter-Temporal Integration (Hierarchical Planning) of**
  - **Strategic Plans**
  - **Tactical Plans**
  - **Operational Plans**

Hierarchical Scope of Supply Chain Decision-making



- Enterprise Integration of
  - Supply Chain Management
  - Demand Management
  - Corporate Financial Management

Objectives of Integrated Supply Chain Management

- If demand is fixed and given, minimize total supply chain cost of satisfying it
  - raw material and other acquisition costs
  - in-bound transportation costs
  - facility investment costs
  - direct and indirect manufacturing costs
  - direct and indirect distribution center costs
  - inventory holding costs
  - out-bound transportation costs

- If product mix is allowed to vary, maximize net revenues

  net revenues = gross revenues - cost

- If product mix is allowed to vary, maximize net revenues

net revenues = gross revenues – cost

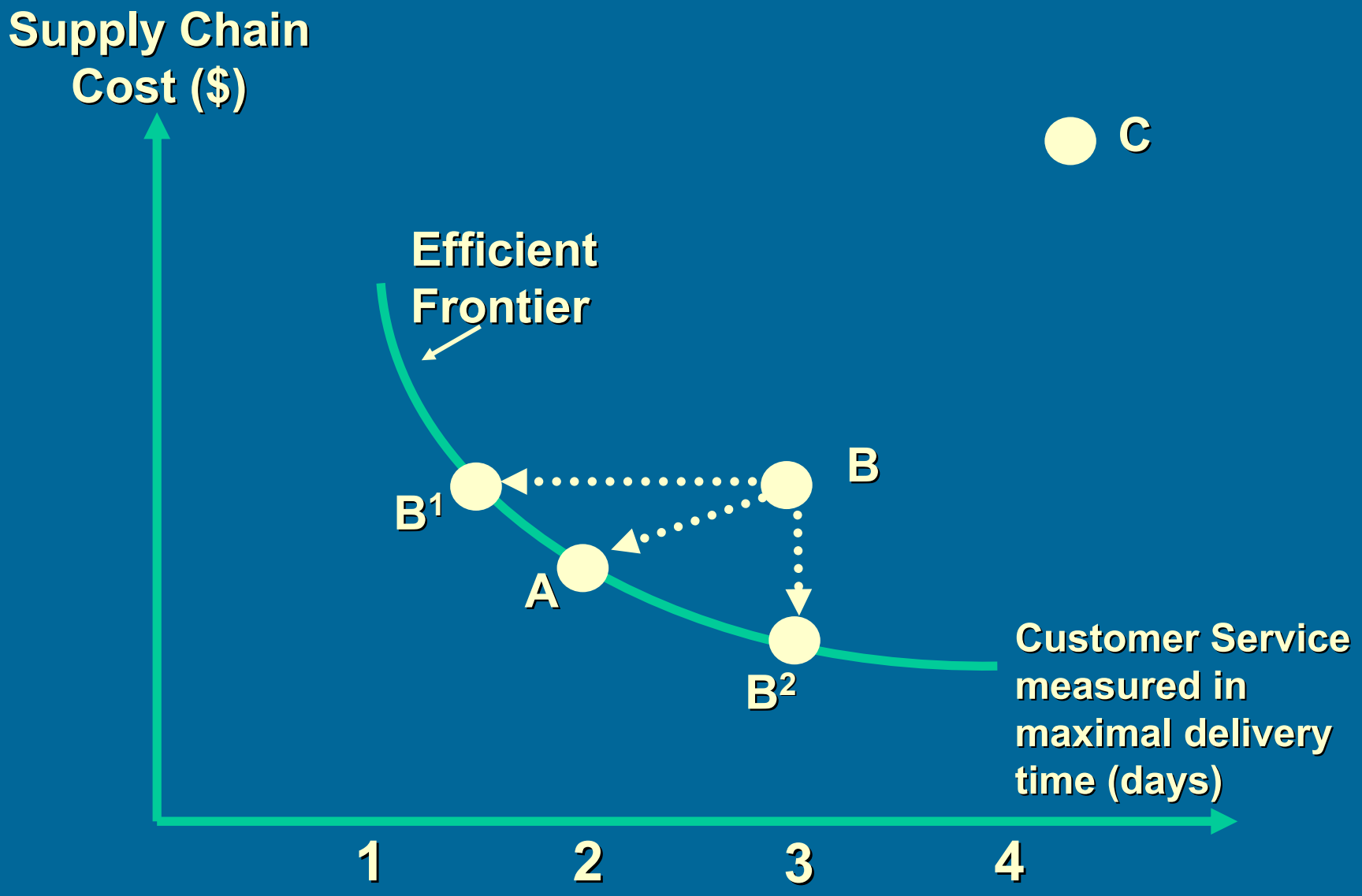
- Cost minimization or revenue maximization involves management of supply chain resources

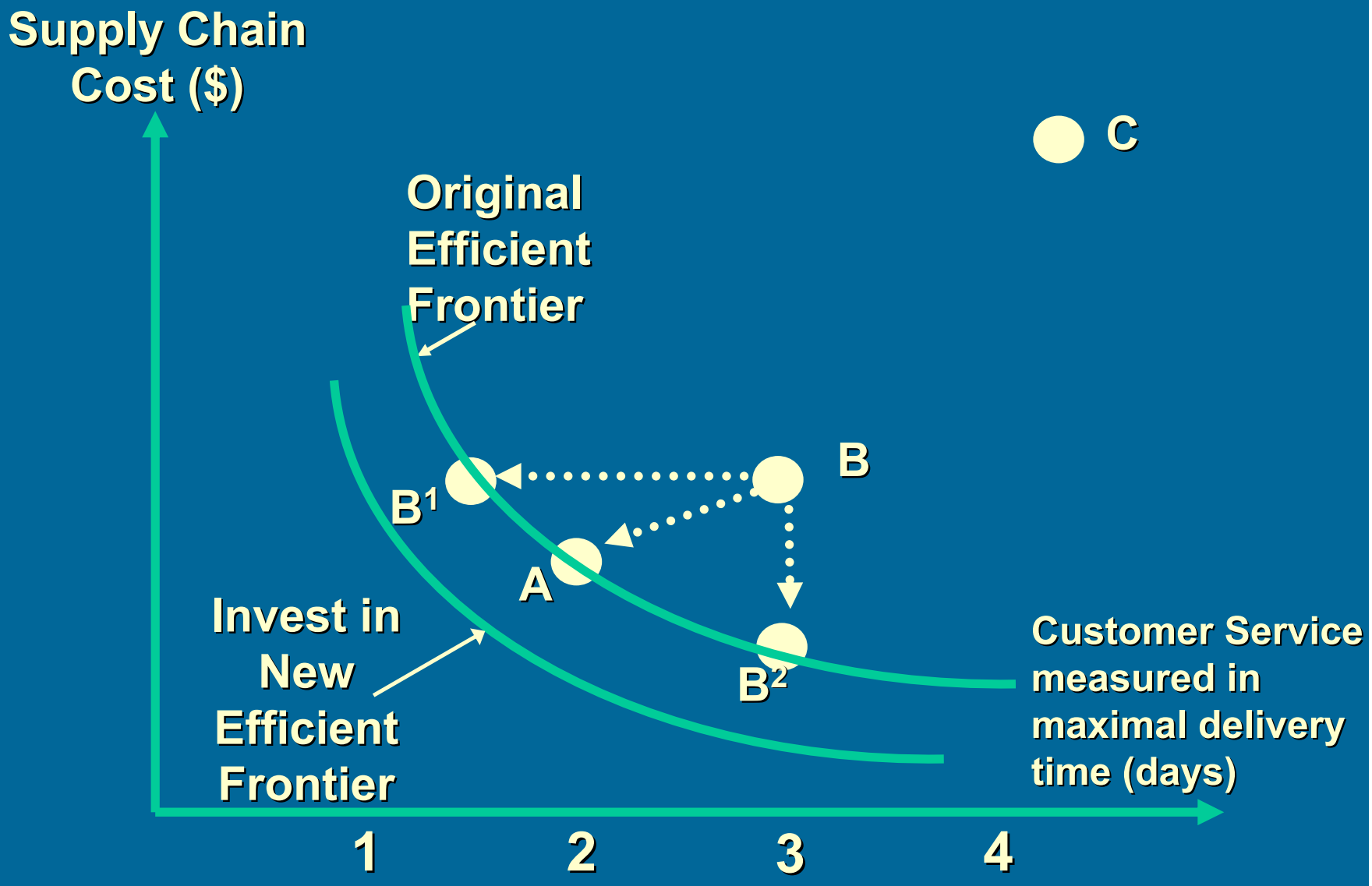
- If product mix is allowed to vary, maximize net revenues
  net revenues = gross revenues - cost
- Cost minimization or revenue maximization involves selection of optimal resource levels and allocations
- Management begins with supply chain design for new products, services and facilities and terminates with their retirement

- The company is also concerned with optimizing customer service, value added services, agility, quality, and time. Management judgment needed to reconcile tradeoffs between cost or revenue and these non-cost factors.

Efficient frontier – Comprised of undominated feasible solutions to supply chain model.

A feasible solution is undominated if no other feasible solution exists that is at least as good with respect to all criteria (cost, time, customer service, etc.) and strictly better on one criterion.


Supply Chain Cost ($)
C
Efficient Frontier
B
B1
A
B2
Customer Service measured in maximal delivery time (days)
1
2
3
4


Supply Chain Cost ($)
C
Original Efficient Frontier
B
B1
A
Invest in New Efficient Frontier
B2
Customer Service measured in maximal delivery time (days)
1
2
3
4

DC Location Study

- Distribution company that buys and sells electronic products
- The company has just acquired the customers and warehouses of a smaller distribution company
- Consolidation and expansion of DC's obviously needed

Study objectives were to develop and exercise an optimization model for evaluating

- Where should new DC's be opened?
- What size should they be?
- Which existing DC's should be shut down?
- For each product, which vendor should replenish each DC?
- How should each market be served?
- What is the tradeoff between delivery time and cost?

Logistics Study Results
(Costs in $1,000's)

	Current	Optimal
Transportation Costs	6,226	5,498
Facility Fixed Costs	1,360	818
Facility Variable Costs	577	879
Facility Shutdown Costs	0	159
Inventory Cost (Safety Stock)	281	319
Total	8,444	7,673

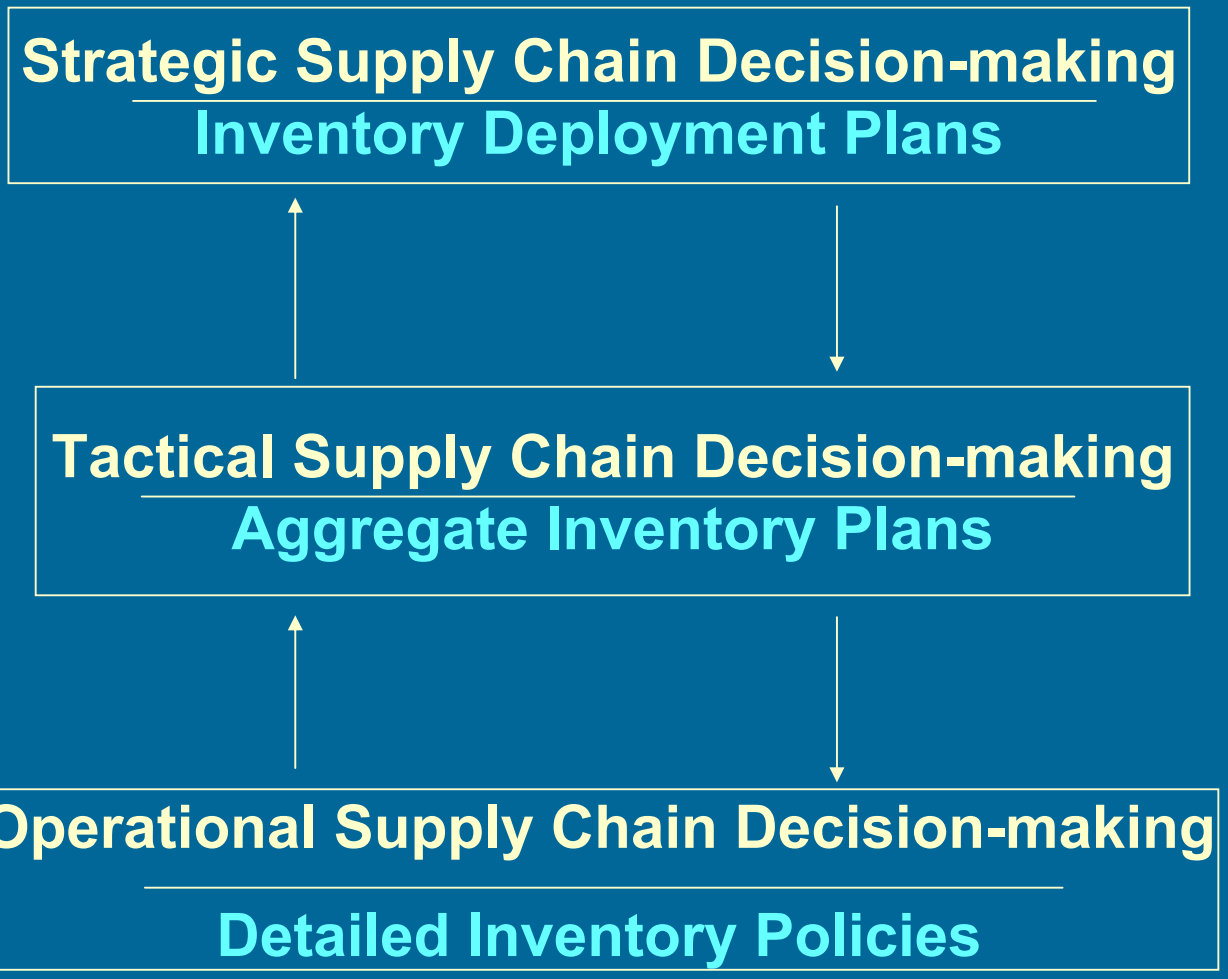
Integrating Inventory Decisions with Location, Production and other Supply Chain Decisions

Reasons for Carrying Inventory

- To create buffers against the uncertainties of supply and demand
- To take advantage of lower purchasing and transportation costs associated with high volumes
- To take advantage of economies associated with manufacturing products in batches
- To build up reserves for seasonal demands
- To exploit speculative opportunities for commodities and other products

General Comments

- Financial analysts rely on sales/inventory ratios in assessing a company's performance
- Recent management thinking is to try to eliminate inventories but good reasons for carrying inventories still exist
- Inventory costs are only one element of total supply chain costs (inventories are dependent control variables)
- Different methods of inventory management and models required for raw materials, parts, components, work-in-process, finished goods
- Inventory holding and stock-out costs vary widely by industry



Hierarchical Planning and Inventory Management