

# | Supply Chain Analytics

## Lecture 14: Conclusion

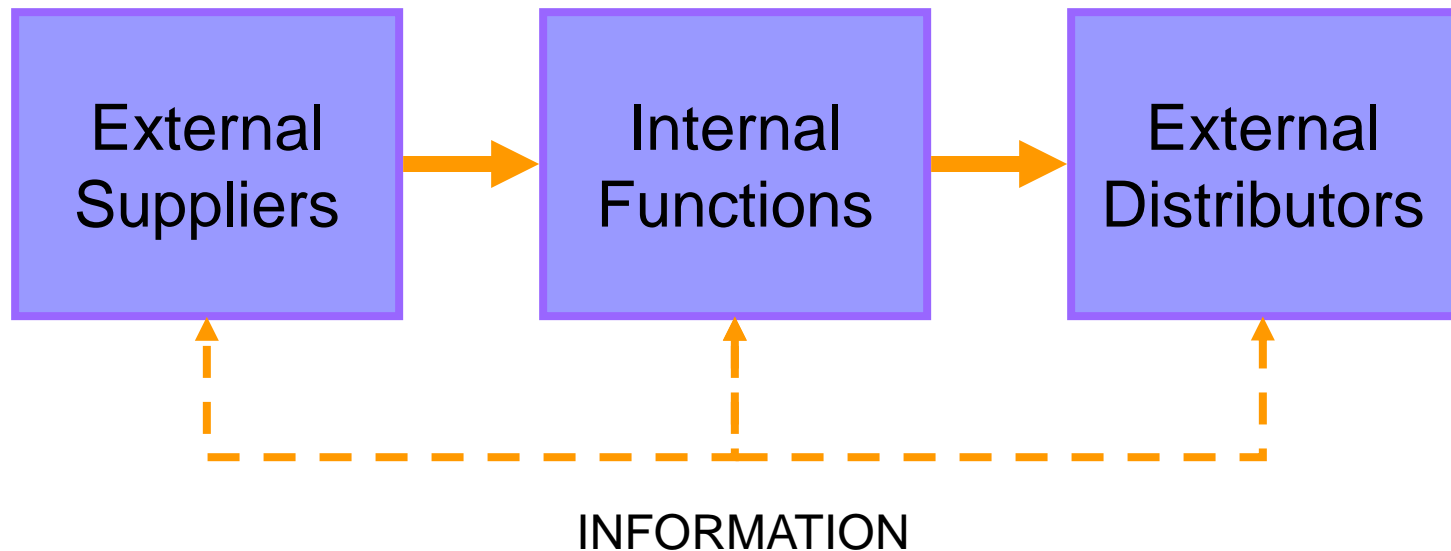
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# SCM FACTORS

**SCM** must consider the following trends, improved capabilities, & realities:

- **Consumer Expectations and Competition** – power has shifted to the consumer
- **Globalization** – capitalize on emerging markets
- **Information Technology** – e-commerce, Internet, EDI, scanning data, intranets
- **Government Regulations** - like trade barriers
- **Environment Issues** – e.g. waste minimization

# COMPONENTS OF A TYPICAL SUPPLY CHAIN



# EXTERNAL SUPPLIERS

External suppliers provide the necessary raw materials, services, and component parts.

Purchased materials & services frequently represent 50% (or more) of the costs of goods sold.

Suppliers are frequently members of several supply chains – often in different roles.

# EXTERNAL SUPPLIERS

## Tier one suppliers:

- Directly supplies materials or services to the firm that does business with the final customer

## Tier two suppliers:

- Provides materials or services to tier one suppliers

## Tier three suppliers:

- Provides materials or services to tier two suppliers

# INTERNAL FUNCTIONS

Vary by industry & firm, but might include:

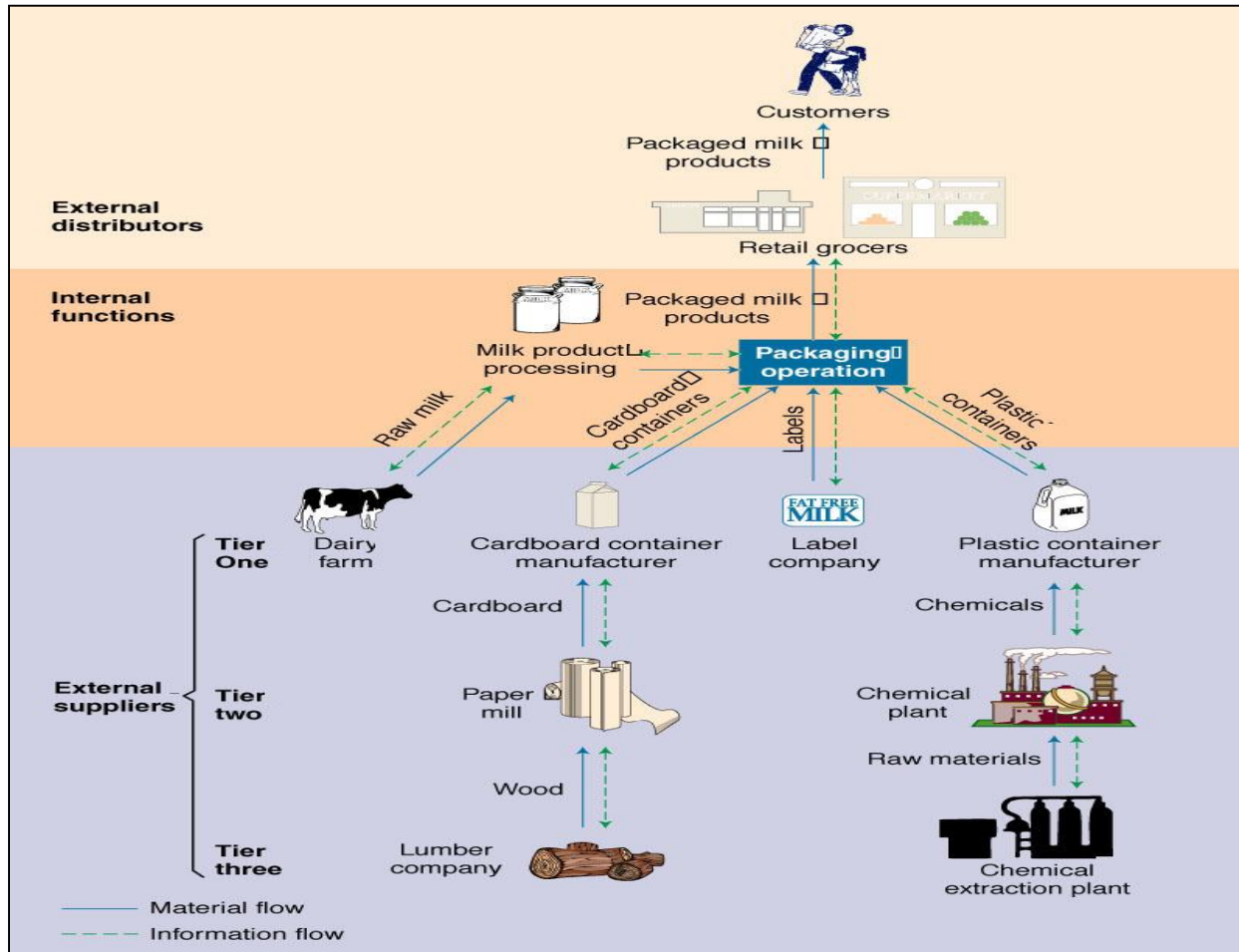
- Processing
- Purchasing
- Production Planning & Control
- Quality Assurance
- Shipping

# LOGISTICS & DISTRIBUTION

Logistics: getting the right material to the right place at the right time in the right quantity:

- Traffic Management:
  - The selection, scheduling & control of carriers (e.g.: trucks & rail) for both incoming & outgoing materials & products
- Distribution Management:
  - The packaging, storing & handling of products in transit to the end-user.

# DAIRY PRODUCTS SUPPLY CHAIN



# VERTICAL INTEGRATION

A measure of how much of the supply chain is controlled by the manufacturer.

- Backward integration:
  - Acquiring control of raw material suppliers.
- Forward integration:
  - Acquiring control of distribution channels.

# OUTSOURCING

Entails paying third-party suppliers to provide raw materials and services, rather than making them in-house.

Outsourcing is increasing as many firms try to focus their internal operations on what they do best.

# INSOURCING VS. OUTSOURCING

## **What questions need to be asked before sourcing decisions are made?**

- Is product/service technology critical to firm's success?
- Is operation a core competency?
- Do you have the capital to provide capacity & keep the process current?
- Will outsourcing extend lead times and limit flexibility?
- Can others do it for less cost and better quality?

# PURCHASING'S ROLE IN SCM

**Purchasing role has attained increased importance since material costs represent 50-60% of cost of goods sold**

- Ethics considerations
- Developing supplier relationships
- Determining how many suppliers
- Developing partnerships

**Industry trend is to a much smaller supplier base. Why?**

# PARTNERING WITH SUPPLIERS

Involves developing a long-term, mutually-beneficial relationship:

- Requires trust to share information, risk, opportunities, & investing in compatible technology
- Work together to reduce waste and inefficiency & develop new products
- Agree to share the gains

# SUPPLIER RELATIONSHIPS AND JIT

Use single-source suppliers when possible

Build long-term relationships

Work together to certify processes

Co-locate facilities to reduce transport if possible

Stabilize delivery schedules

Share cost & other information

Early involvement during new product designs

# THE ROLE OF WAREHOUSES

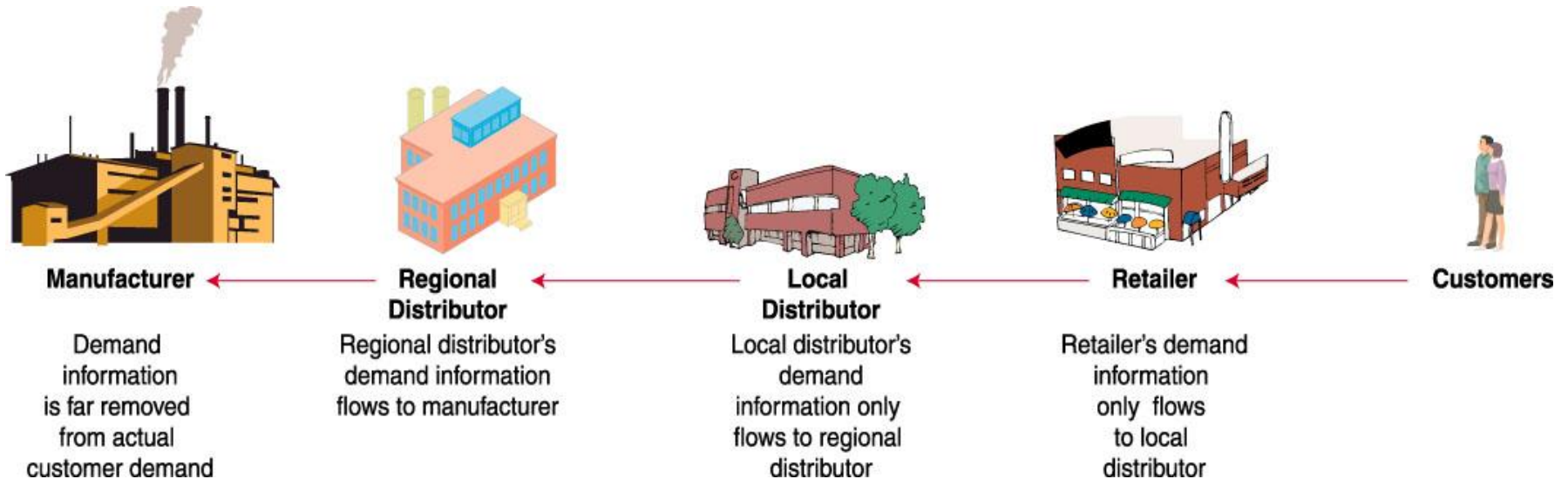
## General Warehouses:

- Used for long-term storage of goods

## Distribution Warehouses:

- Transportation consolidation:
  - Consolidate LTL into TL deliveries
- Product mixing & blending:
  - Group multiple items from various suppliers
- Improve service:
  - Reduced response time
  - Allow for last-minute customization

# INFORMATION FLOW IN SUPPLY CHAINS



# INFORMATION SHARING

Supply chain partners can benefit by sharing information on sales, demand forecasts, inventory levels & marketing campaigns

Inaccurate or distorted information leads to the Bullwhip Effect

# THE BULLWHIP EFFECT

If information isn't shared, everyone has to guess what is going on downstream.

Guessing wrong leads to too much or too little inventory:

- If too much, firms hold off buying more until inventories fall (leading suppliers to think demand has fallen).
- If too little, firms demand a rush order & order more than usual to avoid being caught short in the future (leading suppliers to think demand has risen).

# SHORT-CIRCUIT THE BULLWHIP

Make information transparent:

- Use Electronic Data Interchange (EDI) to support Just-In-Time supplier replenishment
- Use bar codes & electronic scanning to capture & share point-of-sale data

Eliminate wholesale price promotions & quantity discounts

# ELECTRONIC DATA INTERCHANGE

The most common method of using computer-to-computer links to exchange data between supply chain partners in a standardized format.

Benefits include:

- Quick transfer of information
- Reduced paperwork & administration
- Improved data accuracy & tracking capability

# INTEGRATED SCM

## **Implementing integrated SCM requires:**

- **Analyzing the whole supply chain**
- **Starting by integrating internal functions first**
- **Integrating external suppliers through partnerships**

## **Possible Supply Chain Objectives**

- **Reduce costs, improve quality**
- **Reduce lead time and inventory**
- **Reduce time to market**
- **Increase sales**
- **Improve demand data/forecasting**

# COMPUTER SOFTWARE

A variety of software packages are available for solving mathematical models, some are:

- Spreadsheet packages such as *Microsoft Excel*
- *The Management Scientist (MS)*
- *Quantitative system for business (QSB)*
- *LINDO, LINGO*
- *Quantitative models (QM)*
- *Decision Science (DS)*

# MODEL TESTING AND VALIDATION

Often, the goodness/accuracy of a model cannot be assessed until solutions are generated.

Small test problems having known, or at least expected, solutions can be used for model testing and validation.

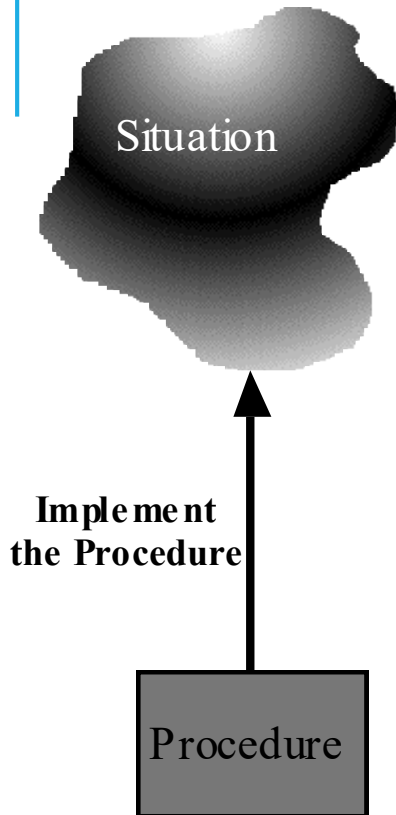
If the model generates expected solutions:

- use the model on the full-scale problem.

If inaccuracies or potential shortcomings inherent in the model are identified, take corrective action such as:

- collection of more-accurate input data
- modification of the model

# IMPLEMENTATION



A solution to a problem usually implies changes for some individuals in the organization

Often there is resistance to change, making the implementation difficult

User-friendly system needed

Those affected should go through training

*Example:* Implement nurse scheduling system in one unit at a time. Integrate with existing HR and T&A systems. Provide training sessions during the workday.

# IMPLEMENTATION AND FOLLOW-UP

Successful implementation of model results is of critical importance.

Secure as much user involvement as possible throughout the modeling process.

Continue to monitor the contribution of the model.

It might be necessary to refine or expand the model.

# REPORT GENERATION

A managerial report, based on the results of the model, should be prepared.

The report should be easily understood by the decision maker.

The report should include:

- the recommended decision
- other pertinent information about the results (for example, how sensitive the model solution is to the assumptions and data used in the model)

# COMPONENTS OF OR-BASED DECISION SUPPORT SYSTEM

Data base (nurse profiles, external resources, rules)

Graphical User Interface (GUI); web enabled using java or VBA

Algorithms, pre- and post-processor

What-if analysis

Report generators



# EXAMPLES OF OR APPLICATIONS

Rescheduling aircraft in response to groundings and delays

Planning production for printed circuit board assembly

Scheduling equipment operators in mail processing & distribution centers

Developing routes for propane delivery

Adjusting nurse schedules in light of daily fluctuations in demand

# EXAMPLE: AUSTIN AUTO AUCTION

An auctioneer has developed a simple mathematical model for deciding the starting bid he will require when auctioning a used automobile. Essentially, he sets the starting bid at seventy percent of what he predicts the final winning bid will (or should) be. He predicts the winning bid by starting with the car's original selling price and making two deductions, one based on the car's age and the other based on the car's mileage.

The age deduction is \$800 per year and the mileage deduction is \$.025 per mile.

# EXAMPLE: AUSTIN AUTO AUCTION

## Question:

Develop the mathematical model that will give the starting bid ( $B$ ) for a car in terms of the car's original price ( $P$ ), current age ( $A$ ) and mileage ( $M$ ).

## Answer:

The expected winning bid can be expressed as:

$$P - 800(A) - .025(M)$$

The entire model is:

$$B = .7(\text{expected winning bid}) \text{ or}$$

$$B = .7(P - 800(A) - .025(M)) \text{ or}$$

$$B = .7(P) - 560(A) - .0175(M)$$

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