MODULE 3

Historical Background

- Inventory lot-sizing models
- Time-series forecasting
- Production Planning & Control
- Purchasing
- Sales & Distribution

All these functions have existed for a century!

- Inventory models came under attack (70’s)
- Enter MRP → MRP II → ERP
- And from Japan, JIT, TQM, Kaizen, etc.

What Happened Thereafter?

- Need for better coordination /integration of functions
- Shorter time to manufacture
- Globalization
- Emergence of IT
- Led to the evolution of
Evolution

What Is Supply Chain?

[Diagram showing the evolution of supply chain management, from basic rules to more advanced planning tools like Enterprise Resource Planning and Supply Chain Management.]
Or………. Is It This ?

Supply Chain Management

Is a total systems approach to managing the entire flow of information, materials and services from raw material suppliers through factories, distribution centers and warehouses to the customer.
Overview Of Supply Chain

- Customers
- Supplier
- Distributor
- Factories/Plants
Supply Chain Types

External Supply Chain

- Involving other companies.

Internal Supply Chain

- Involving functions / departments /
- business units within the organisation.
Scm Functional Decisions

1. Procurement (Purchasing) decisions
   - Supplier selection
   - Sourcing / purchasing
   - Vendor Managed Inventories

Objectives Of Purchasing
   - Provide uninterrupted flow of materials
   - Buy competitively and wisely
   - Minimize inventory holding costs
• Source development
• To develop good vendor relationships
• Achieve maximum integration with other departments
• Train purchase personnel
• To develop policies and procedures to achieve objectives (1-7)

**Purchasing Must Provide Material Of**

- Right Quality
- Right Source
- Right Price
- Right Quantity
- Right time
Right Quality

- Involves many factors:
  - Price, installation cost, maintenance cost, life expectancy, market availability, workability and attitude of users
- Must balance three major considerations

  How to determine?
  How to define?
  How to control?

Describe such that vendor understands

Engineering Versus Economic

Right Source

- Influences the other 4 “Rights”
- Supplier goodwill
- Supplier identification (yellow pages), evaluation / rating and selection
- Buyer Seller relationships and ethics
- Factors to be considered include
  - Quality, cost, delivery, credit terms distance etc
- In periods of stability, prosperity, recession
Right Price

- Perfect competition
- Imperfect competition
- Monopoly

- Analyze price lists
- Competitive bidding
- Negotiation

- Fixed price
- Cost type

- Quantity, seasonal, cash

Methods

Contracts

Discounts

Right Quantity

- **Inventory Control – traditional approach**
- **Material Requirement Planning (MRP)**
- **Just In Time (JIT) and Zero Inventory**

Right Time

*Timing Policies:*

- **Purchase according to current requirements (1 to 3 Months)**
- **Purchase according to market conditions**
• Hand-to-mouth buying
• Forward buying (3 to 12 months)
• Speculative buying
• Depends on lead times
• Decides “When to order”
• JIT concepts

Scm Functional Decisions

2. Production decisions

• Process Design
• Manpower management
• Quality
• Inventory management
• Capacity planning and scheduling
3. Logistics decisions

What is Logistics?
Scm Functional Decisions

- Logistics decisions
- Materials Management Decisions (Inbound)
- Sales forecasting
- Order processing
- Inbound transportation
- Physical Distribution Decisions (Outbound)
- Configuration of distribution facilities
- Location of facilities
- Mode of transport
- Vehicle routing
Physical Distribution Decisions

- *When to deliver the products*
- *Where to deliver the products*
- *How to deliver the products at a reasonable cost.*
TYPICAL CHANNELS OF DISTRIBUTION

MANUFACTURER → AGENT → RETAILER → CONSUMER
Physical Distribution Objectives

Distribution Channel Functions

Physical Distribution: Vehicle Routing Decisions

Role Of Information Technology In Scm

IOIS – Inter-organizational Information System
- **EDI**: Electronic Data Interchange
- **ERP**: Enterprise Resource Planning
• **Barcode System**
  - Identifying products, services, assets and locations throughout the world

• **Data Mining and Warehouse (Database)**

• **Intranet (within companies)**

• **Extranet (between partners)**

• **Internet (WWW – World Wide Web)**

• **Decision Support System**

**Supply Chain Optimization**

Optimization is used to improve a company’s supply chain performance in variety of areas

- **Lower Supply Costs**
- **Higher Profit Margins**
- **Increased Manufacturing Throughput**
- **Better Return on Assets**
### Scope Of Supply Chain Modeling

#### Three Levels Of Decision Hierarchy

<table>
<thead>
<tr>
<th>Strategic</th>
<th>Tactical</th>
<th>Operational</th>
</tr>
</thead>
</table>
| - Location-allocation decisions
  - Demand planning
  - Distribution channel planning
  - Strategic alliances |
| - Inventory control
  - Production / distribution coordination
  - Order/freight consolidation |
| - Vehicle routing/scheduling
  - Workforce scheduling     |
| - Outsourcing
  - Supplier selection
  - Information technology selection
  - Pricing
  - Network restructuring    |
| - Material handling
  - Equipment selection
  - Layout design             |
| - Record keeping
  - Packaging                |
Modeling Approaches To Scm

Supply Chain Modeling

- Deterministic
- Stochastic
- Hybrid

Heuristic

IT Driven

Simulation

Network Design

MIP Optimization

Optimal Control

Dynamic Programming

WMS

ERP

GIS

WMS – Warehouse Management System
ERP – Enterprise Resource Planning
GIS – Geographic Information System
Deterministic Models

Assumption:

Model parameters are known with certainty.

(i) Network Models.

- Determine location of production, stocking, and sourcing facilities, and channels through which the products flow.


Includes models for

- vehicle routing and scheduling,
- facility location and sizing,
- shipment routing and scheduling,
- freight consolidation and
- selection of the mode of transportation.

np-complete - not amenable to optimization.

Stochastic Programming

- Some of the variables are not deterministic.
- Such models are appropriate
- When data evolve over time and decisions need to be made prior to observing the entire data stream.
Robust Optimization Models

Uncertainty about problem data is treated as unknown-but-bounded. Intervals of confidence for the data are considered.

Heuristic Models

- Intelligent approach that attempts to find good solutions.
- Empirical approached problem solving
- Thumb Rule
- Quick and Effective
- No guarantee of optimum
- Adequate for real life

Simulation Models

- Both strategic & operational elements.
- Evaluate alternative policies or decisions.
- Dynamic nature of supply chains.

Hybrid Models

- Both deterministic & stochastic models.
- Inventory-theoretic & simulation models.
- Deal with both certainty and uncertainty.
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IT Driven Models

- Warehouse management system (WMS)
- Transportation management systems (TMS)
- Integrated transportation tracking,
- Collaborative planning and forecasting
- replenishment (CPFR),
- Material requirement planning (MRP),
- Distribution resource planning (DRP),
- Enterprise resource planning (ERP), and
- Geographic information systems (GIS).
Requirements For Effective Scm

Information Handling

- *Lightness of data transferring* – only essential information (not GIGO !)
- *Transparency and speed of information*


- Accurate
- Timely access
- Defining the right amount of information for each level

**Information Handling (Contd.)**

- Information to right people

To ensure that information reached the recipi

- ent
- To prevent and control data seepage
Implementation

Co-operation, not Competition: Focus on jointly solving problems, not looking for someone to blame.
It Difficulty

"On the Internet, nobody knows you're a dog."
On the Internet, nobody knows you’re a dog

Trade-off between

Accessibility

and

Security
### Scm – Overall Drawbacks

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
<th>Benefits</th>
<th>Possible Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large inventories</td>
<td>Smaller, more frequent deliveries</td>
<td>Reduced holding costs</td>
<td>Traffic congestion Other costs</td>
</tr>
<tr>
<td>Long lead times to manufacture, to procure</td>
<td>Delayed differentiation No transfer of load (point to point)</td>
<td>Quick response</td>
<td>May not be feasible Lack of functional integration</td>
</tr>
<tr>
<td>Large number of parts</td>
<td>Modular</td>
<td>Fewer parts Simpler ordering</td>
<td>Less variety</td>
</tr>
<tr>
<td>Quality cost</td>
<td>Outsourcing</td>
<td>Reduced cost, higher quality</td>
<td>Loss of control</td>
</tr>
<tr>
<td>Variation in demand, MPS, etc.</td>
<td>Shorter lead times, better forecasts</td>
<td>Able to match supply and demand</td>
<td>Less variety</td>
</tr>
</tbody>
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### The Future Of Scm

- **Soft issues**
- **Multi-objective formulations**
- **Dynamic decision rules**
Design of model-based Decision Support System

Shall we dream of an IT-driven, Customer-friendly, People-sensitive Supply Chain Management System?

WHERE DOES SCM STAND TODAY?

Fragmented!
Production managers don't know enough IT

IT professionals don't know enough Operations Management