Supply Chain Management

–Model & Technology-–

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Room S223

Lecture 1

Objectives of the Class / B2B

Learn about inventory management and demand management in manufacturing systems and Supply chain management basics

- Inventory theory
- Production Scheduling
- Supplier management
- Logistics planning
- Demand forecasting

and more…

Lecture manner

Lecture material (pdf) will be uploaded on lecture Web site at the following URL until previous day's (Thursday) morning.

http://www.f.waseda.jp/t-murata/class/scm.htm

◆Please download and print it out by yourself. (Printed materials won't be delivered)

◆Achievement grading policy:

Attendance (10%), Homework(10%)
Examination (80%)

Lecture plan schedule

1 Introduction (9/29)
2 Inventory theory (1)（10/06)
3 Inventory theory (2) & order operation(10/13)
4 Bullwhip effect & Beer Game(10/20)
5 Playing Beer Game (10/27)
5 No class (11/10) : Reading assignment
6. Network inventory (11/17)
7. Basics of MPS & MRP (11/24)
8. Capacity Planning & MRP-C (12/01)
10. TOC & DBR scheduling (12/08)
11. Just In Time & Lean manufacturing (12/15)
12. Forecasting & Demand Management (12/22)
13. Aggregate Planning and Transportation Planning(1/12)
14. Supplier Selection and B2B e-commerce (1/19)
15. Exam (report) No class (1/26)

↓
last day.

References

English books:

Supply Chain Management - strategy, planning, and operation (2nd Ed.)
S.Chopra, P.Meindl, PremticeHall

Supply Chain Management and Advanced Planning (2nd Ed.)
Stadtler, Kilger (Eds) , Springer

Manufacturing Planning & Control System for SCM (5th Ed.)
T. E. Vollmann , W.L Berry, et. al. McGrow-Hill

Japanese books:

革新的生産スケジューリング入門
佐藤知一, 日本能率協会マネージメントセンター

BTO 生産システム
中根甚一郎 編、 日刊工業新聞社

制約管理ハンドブック
James F. Cox, Michael S. Spencer, 小林英三訳 ラッセル社

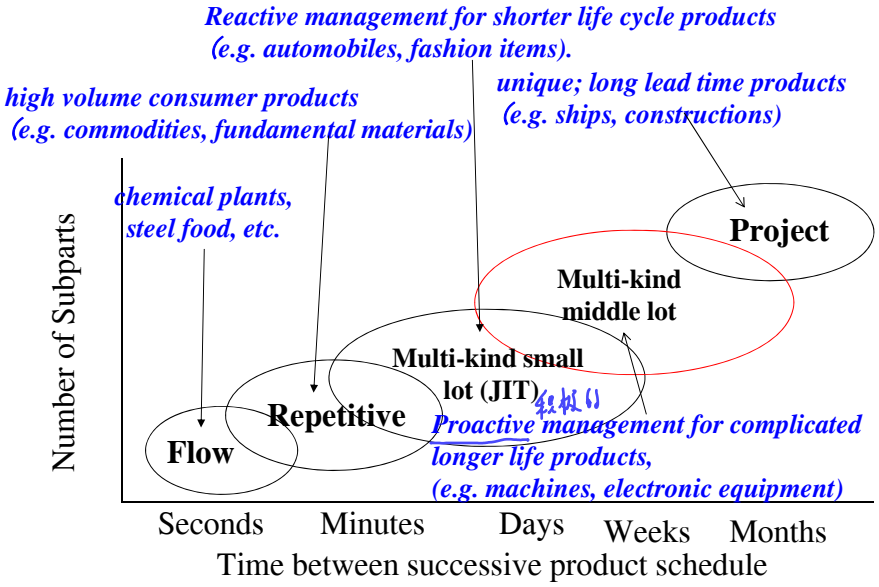
サプライチェーンの設計と管理
D.スミチ・レビ他 久保幹夫（監修）、朝倉書店

Today's Content

INTRODUCTION of Manufacturing Planning Control

- ✓ What is **MPC**
- ✓ Understanding **MPC**
- ✓ What is Supply Chain Management
- ✓ Understanding Supply Chain Management
- ✓ SCM integration

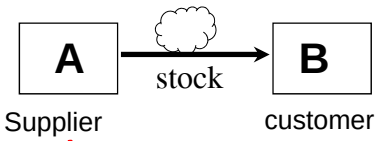
1.1 Production System Classification



1.1 Production System Classification

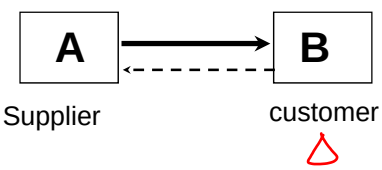
Push & Pull system

Push system: Completed "A" products are sent (pushed) to "B" regardless of system conditions.



- **Driven by plan and forecast.**
- **Cost effective but more time to react to changing market place**

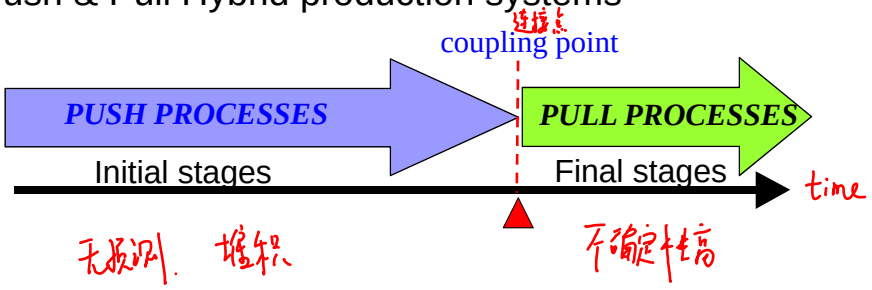
Pull system: Removal of a product from the Finished Goods Inventory (FGI) buffer signals the execution of inventory change, and trigger the execution of supply from "A".



- **Driven by customer demand**
- **Can eliminate inventory**
- **Difficulty of keeping customer service level for longer leadtime**

1.1 Production System Classification

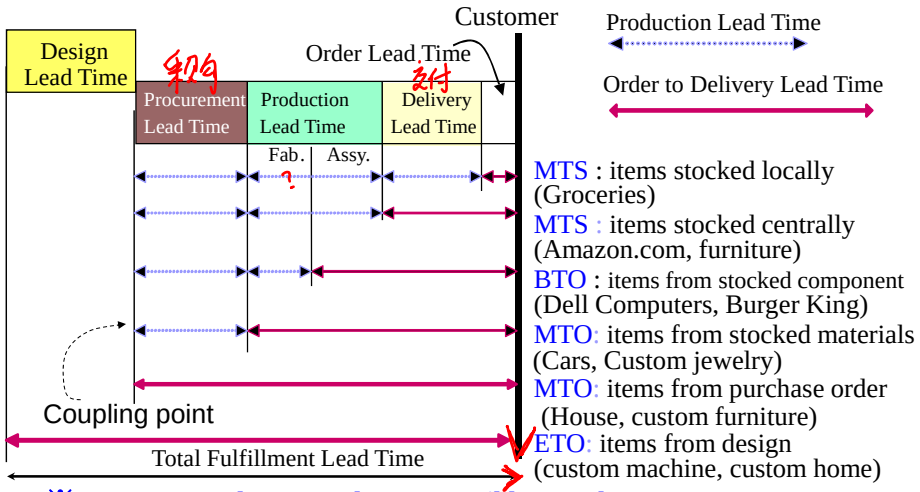
Push & Pull Hybrid production systems



- **The push part - where long-term forecasts have small uncertainty and variability.**
- **The pull part - where uncertainty and variability are high**
- **Buffer management at coupling point is important to control inventory and responsiveness**

1.1 Production System Classification

Push-Pull hybrid production system classification



※ **MTS: Make To Stock, BTO: Build To Order, MTO: Make To Order, ETO: Engineering To Order**

1.1 Production System Classification

Example : BTO in PC industry

① Stock necessary parts set and picking them with respect to customized PC orders

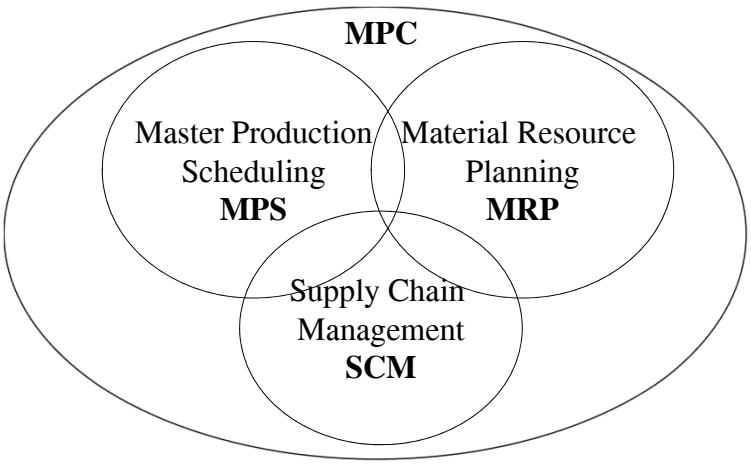
② Input part set data (rev.) to be assembled into database

③ Each worker assembles customized PCs at cell

組裝

1.2 What is a Manufacturing Planning Control ?

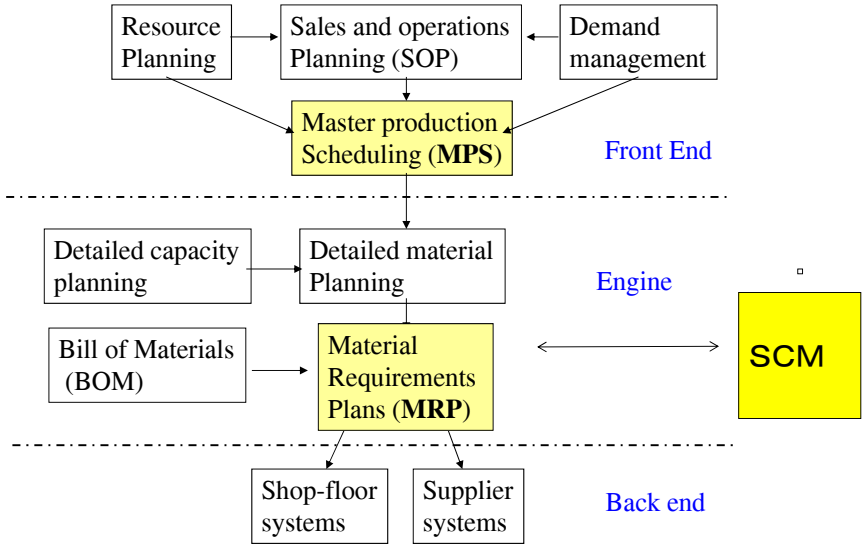
製造業



focusing on **Multi-kind middle lot production**

MPS
MRP
SCM

1.2 What is a Manufacturing Planning Control ?



1.2 What is a Manufacturing Planning Control
What is MPS ?

- A Master Production Schedule or MPS is the master of all schedules that a company has developed for production, inventory, staffing, etc.

- A Master Production Schedule sets the quantity of each end item (final product) to be completed in each week of a short-range planning horizon.

- The Master Production Schedule gives the information to production, purchasing, and top management which is needed to plan and control the manufacturing operation.

- Details in Lecture #7, #8

1.2 What is a Manufacturing Planning Control
What is MRP ?

➢MRP calculates and maintains an optimum manufacturing plan based on master production schedules, sales forecasts, inventory status, open orders and bills of material.

➢MRP will plan production so that the right materials are at the right place at the right time and will provide you with the ability to be pro-active rather than re-active in the management of your inventory levels and material flow.

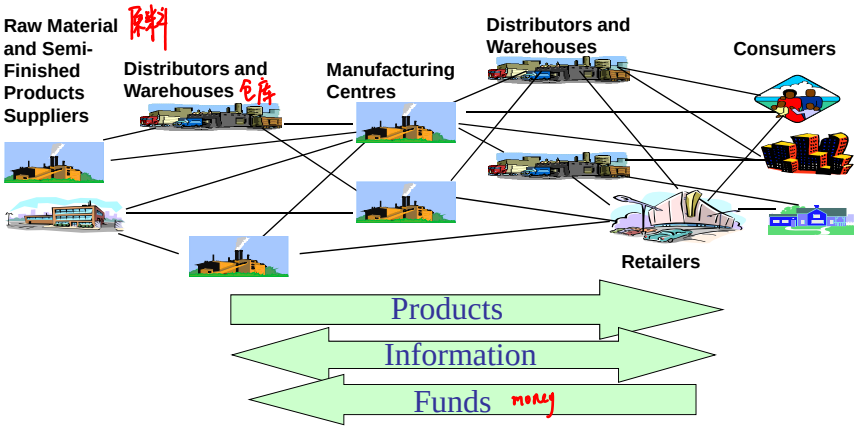
➢Proper Material Requirements is the single most powerful tool in guiding inventory planning, purchase management and production control and it will reduce cash flow and increase profitability when it is properly implemented.

➢Details also in Lecture #7, #8

1.3 What is a Supply Chain? : Flow network

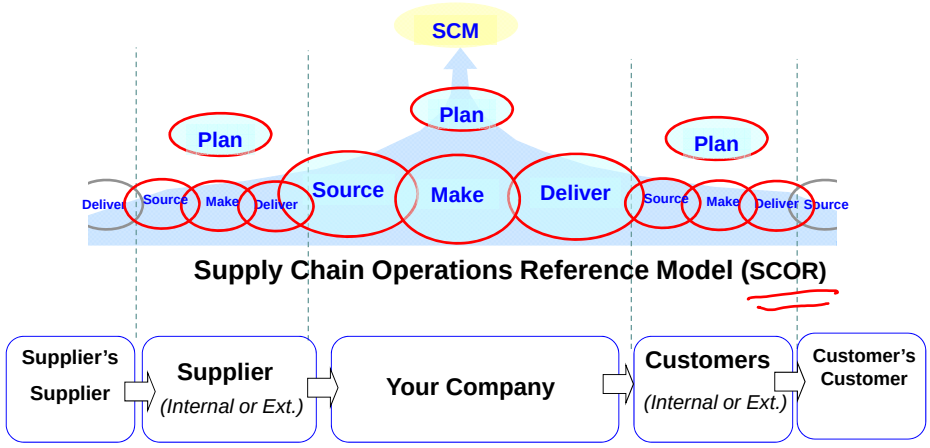
It includes movement of products from suppliers to manufacturers to distributors to customer, but also includes movement of *information*, *funds*, and *products* in both directions

Typical supply chain stages:
customers, retailers, distributors, manufacturers, suppliers



SCM → plan → { Source → Maker → Deliver

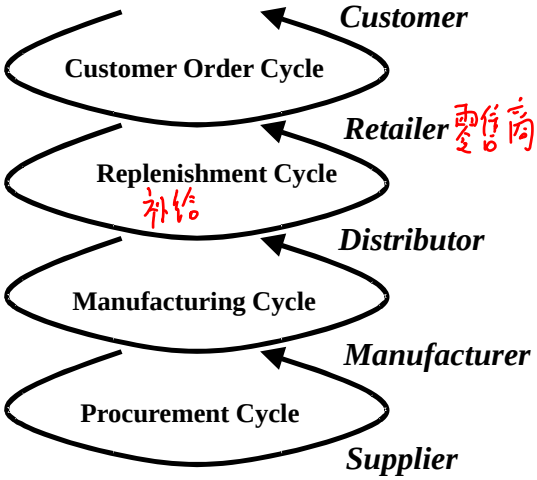
1.3 What is a Supply Chain? : Activities chain



Source: Sourcing and procurement
Make: Production scheduling and manufacturing, Order processing, Inventory management, Warehousing, Customer service
Deliver: Distribution of partly manufactured or final products

1.3 What is a Supply Chain Management ?

Supply Chain dynamic cycle



SCM is the management of flows among supply chain stages and players to increase Supply chain profitability by minimizing system wide supply chain costs* with satisfying throughput & service level

1.3 What is a Manufacturing Planning Control
What is a Supply Chain?

Category of industry（or products）that especially needs SCM

SCMを特に必要とする業種（商品）のカテゴリ

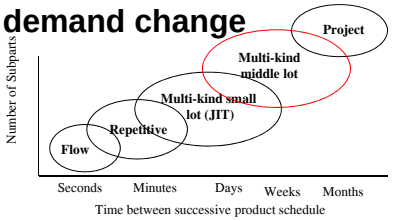
SCM 特徴

（1）many sort and middle amount production
多品種中量生産

（2）products which need wide area logistic networks
ロジステックスのネットワークが広い

（3）large temporal fluctuation of demand change
需要の時間的変動が大きい

（4）short lifecycle products
製品のライフサイクルが短い



1.4 Understanding SCM
Supply chain value and performance

生産

The **value a supply chain generates (i.e. supply chain profitability)** is the difference between what the final product is worth to the customer and the effort the supply chain expends in filling the customer's request and the vale will be strongly correlated with **supply chain performance**, which can be measured by the difference between revenue generated from the customer and overall cost across the supply chain.

収益

1.4 Understanding Supply chain Management

Supply chain performance Metrics

Perspective	Metrics
Reliability	On-time delivery Order fulfillment lead time Fill rate (fraction of demand met from stock) Perfect order fulfillment
Flexibility	Supply chain response time Upside production flexibility
Profit / Expenses	Supply chain management costs Warranty cost as a percent of revenue Value added per employee
Assets / utilization	Total inventory days of supply Cash-to-cash cycle time Net asset turns

1.4 Understanding Supply chain Management

What Makes SCM Difficult ?

(1) Dynamics: Variations Over Time

Environment changes over time

ex.

- Customer demand and supplier capabilities change over time
- Customer-supplier relationship changes over time (customer power increases, etc.)
- Seasonality of demand
- Competitors pricing strategies change
- Advertising and promotions effect to demand

1.4 Understanding Supply chain Management

What Makes SCM Difficult? –cont.

(2) Uncertainty

- **Demand uncertainty:**
  uncertainty of customer demand itself
- **Implied demand uncertainty:**
  the uncertainty that exists due to the portion of the demand due to the needs of customer regarding supply attributes

see the next slide:

1.4 Understanding Supply chain Management

What Makes SCM Difficult? - cont.

Impact of Customer Needs on Implied Demand Uncertainty

Customer Needs	Causes implied demand uncertainty
Range of quantity increases	Wider range of quantity implies greater variance in demand
Lead time decreases	Less time to react to orders
Variety of products required increases	Demand per product becomes more disaggregated
Number of channels increases	Total customer demand is now disaggregated over more channels
Rate of innovation increases	New products tend to have more uncertain demand
Required service level increases	Firm now has to handle unusual surges in demand

1.4 Understanding Supply chain Management

Right Supply Chain for Your Business

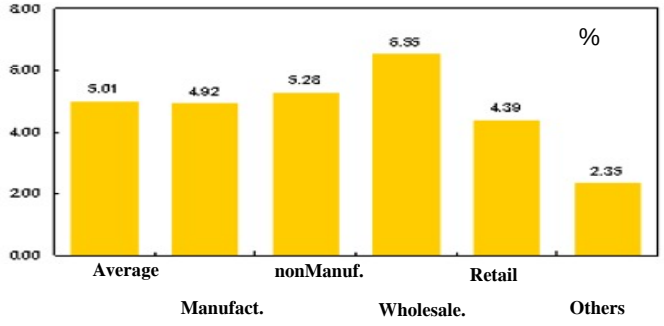
Responsiveness: vs. Efficiency

Factor	Efficient Supply Chains	Responsive Supply Chains
Operations strategy	Cost minimum high volume, standardized products, or services	Throughput maximum under product or service variety
Capacity cushion	Low	Adaptive
Inventory investment	Low; enable high inventory turns	As needed to enable fast delivery time
Lead time	Shorten, but do not increase costs	Shorten aggressively for Order to Deliver
Supplier selection	Emphasize low prices consistent quality on-time delivery	Emphasize timely delivery customization volume flexibility high performance design

1.4 Understanding Supply chain Management

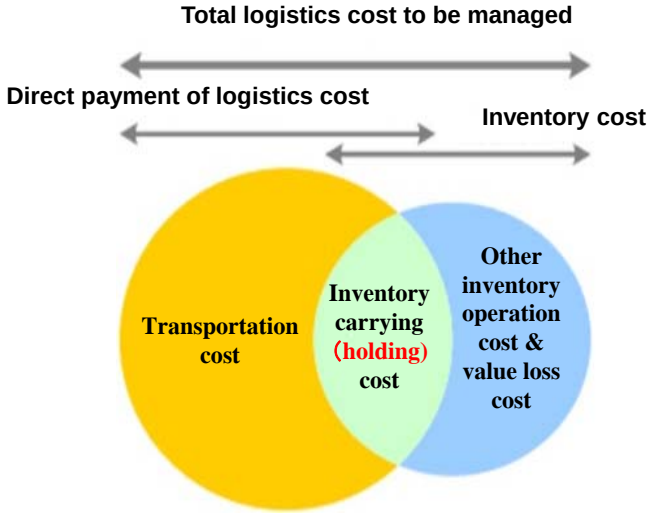
* **Supply Chain Costs**: Acquisition, Storage, Transportation, Repair, Maintenance, Production Operation, Information, Salvage / resale, Disposal, Recycle, etc.

Example: Supply chain logistics cost



Ratio of Logistics cost against amount of Sales (Source JILS 2006)

1.4 Understanding Supply chain Management



Logistics cost configuration

结构

1.5 Strategy of Supply Chains

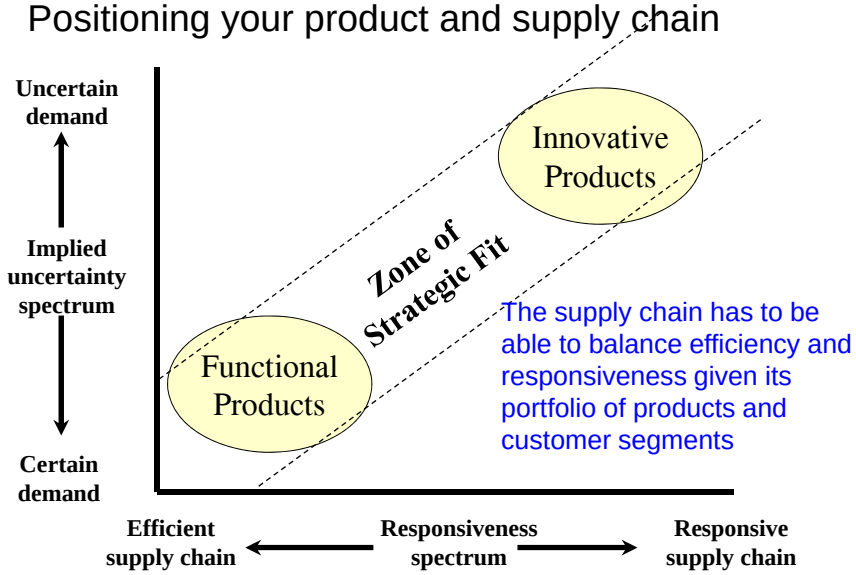
标准

Criteria with Supply Chain Strategy Fitting

- **Supply Chain Type**
  Responsiveness vs. efficiency
- **Level of Uncertainty**
  implied uncertainty (high / low)
- **Nature of Product**
  Functional / innovative

1.5 Strategy of Supply Chains

Positioning your product and supply chain



1.5 Strategy of Supply Chains

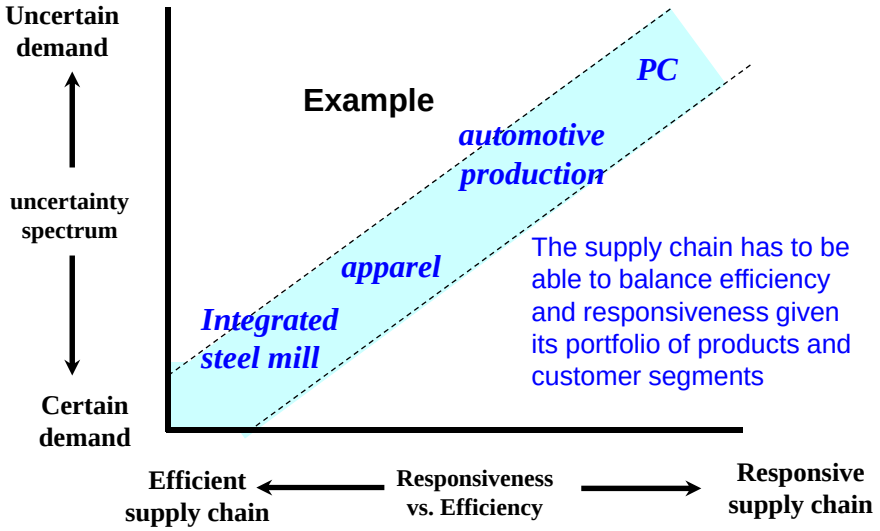
nature of product innovation

- Functional products: Ex.) Staples, Detergent, Long lead time steel
  Stable predictable demand & long life cycle
- Innovative products: Ex.) High Fashion, new Electronic devices.
  Unpredictable & short life cycle

Attributes	Functional	Innovative
Product Lifecycle	> 2 years	3 months. to 1 year
Product margin	**Low**	**High**
Avg. forecast error	**10%**	**40%-100%**
Avg. stockout rate	**1%-2%**	**10%-40%**
Avg. forced season-end markdown	**0%**	**10%-25%**

1.5 Strategy of Supply Chains

Examples of Strategic zone Fit of SC



1.5 Strategy of Supply Chains: typical SCM types

(1) Lean supply chain (LSC) :

Pull production driven efficient supply chain with minimum overhead cost

Lean supply chain employs just in time production (also known as the **Toyota Production System** or JIT) which seek out the systematic elimination of waste - overproduction, waiting, transportation, inventory, overprocessing, and the highly optimized implementation of continuous flow and customer pull.
Not very adaptable to future market requirement change

(2) Hybrid supply chain (HSC) :

Push-Pull hybrid production driven supply for adapting dynamic demand

A hybrid supply chain helps to achieve mass customization by **Postponing** product differentiation until final assembly. The lean supply chain is utilized for component production. The agile part of the chain establishes a company-market interface to understand and satisfy requirements by being responsive and innovative

1.5 Understanding Supply chain Management

Strategy of Supply Chains: typical SCM types

(3) Agile supply chain (ASC) :

Flexible organization driven flexible supply chain

Agile supply chain responds to unpredictable market and technology changes, and capitalizes on them and exploits a dynamic type of alliance that dynamically integrate core competencies distributed among a number of carefully chosen but real organizations.
To realize this type supply chain system, it requires not only flexible organization structure but also virtualized and seamless integration of enterprise information system (i.e. Virtual Enterprise System)

This topics is beyond the area of this lecture.

1.6 Supply chain integration

Integration Criteria involves:

- (Hierarchical) Planning integration with coherence and consistency among overlapping supply chain decisions at various levels of planning
- Flow network integration
- Spatial Integration across geographically dispersed ~~vendors,~~ facilities, markets
- Functional Integration of purchasing, manufacturing, transportation, warehousing
- Information Sharing

1.6 Supply Chain integration : Planning integration

Hierarchical Planning of SCM

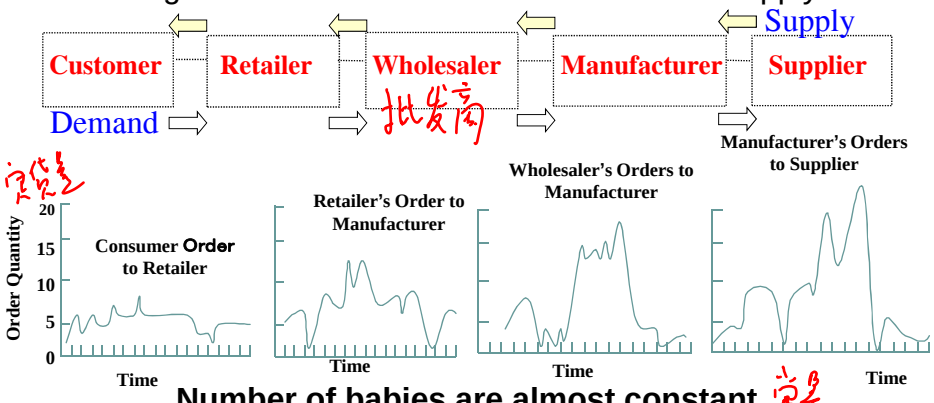
- **Strategic level decisions** – (long term)
  - Location, capacity, new product development, technology management, modes of transportation
  - Scale: years
- **Tactical level decisions** – (medium term)
  - Inventory policies, distribution channel, resource and product allocation, subcontracting, promotion
  - Scale: month- year
- **Operational level decisions** – (short term)
  - Scheduling, vehicle assignment and routing, sourcing and production orders
  - Scale: minute, hour and days

1.6 Supply Chain integration : Flow Network integration

Bullwhip Effect

Procter and Gamble, manufacturers Pampers

The supply chain for Pampers is broadly as follows and the following demand curves are observed in PG's supply chain



Number of babies are almost constant

How come there is such a variability in the demand ?

1.6 Supply Chain integration: Flow Network integration

Bullwhip Effect cont.

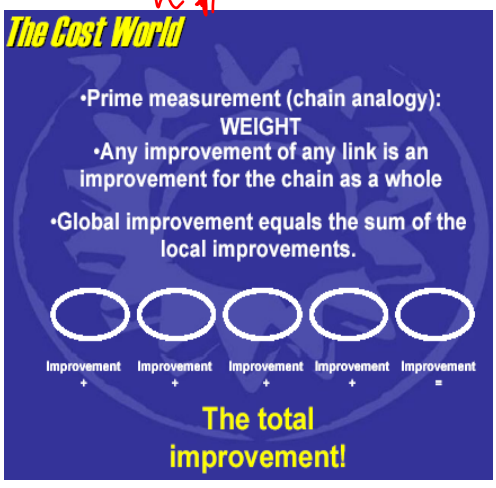
CAUSES OF THE BULLWHIP EFFECT

- Lack of partnerships keep everyone starved for real, consistent information
- Demand Forecast Updating
- Order Batching
- Long lead times
- Inflated orders during shortages (Shortage Gaming)
- Price Fluctuations & Promotions

1.6 Supply Chain integration: Flow Network integration

Throughput management : TOC

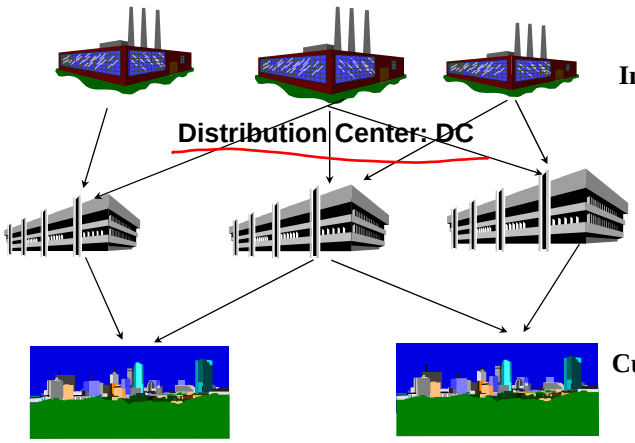
analogy of chain



1.6 Supply Chain integration

Spatial Integration :

Logistics cost structure



Inbound Transport

+

DC Handling

+

Inventory

+

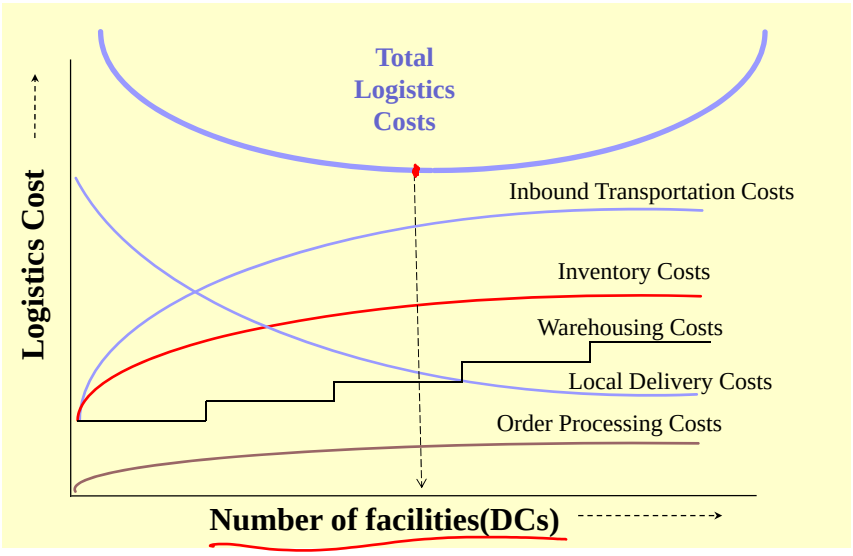
Customer Transport

Total Cost

1.6 Supply Chain integration

Spatial Integration :

Logistics Cost optimization under Trade-Offs



1.6 Supply Chain integration **Spatial Integration :**

Example: National Semiconductors′ facility network:

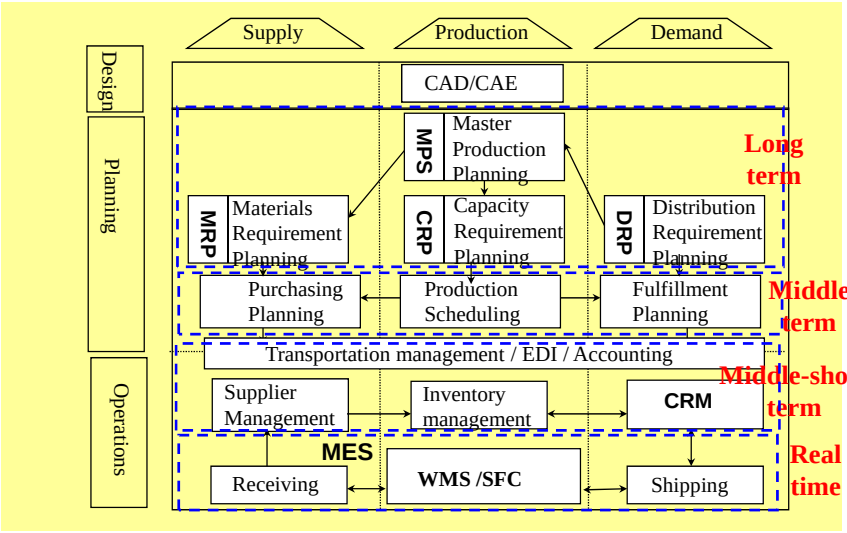
Production:

- Produces chips in six different locations: four in the US, one in Britain and one in Israel
- Chips are shipped to seven assembly locations in Southeast Asia.

Distribution

- The final product is shipped to hundreds of facilities all over the world
- 20,000 different routes
- 12 different airlines are involved
- 95% of the products are delivered within 45 days
- 5% are delivered within 90 days.

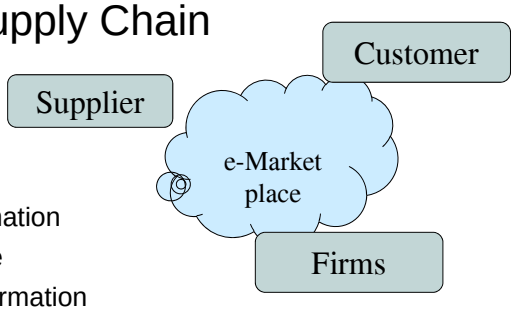
1.6 Supply Chain integration: Functional **Information Infrastructure**



MES: Manufacturing Execution System APS : Advanced Planning System
WMS: Warehouse Management System SFC: Shop floor Management System

1.6 Supply Chain integration : e-business

Internet-enabled Supply Chain



Business to business (B2B)

- Product ordering
- Sharing product information
- Creating display space
- Defining customer information
- Co-developing products

Business to Customer (B2C)

- sharing packing, shipping, inventory, product movement trends and forecasts with the supply chain partners.

IT platforms :
Commerce server 、
Online transaction processing
e -payment、search engine
Security、e -certification、
authentification、
product code, Tag set（XML）
etc.