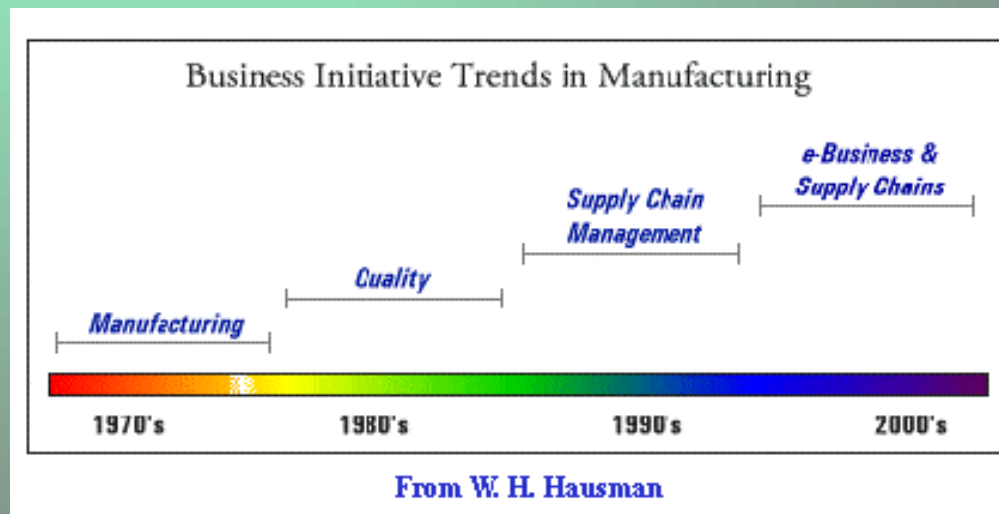


Supply Chain Management as Complex System

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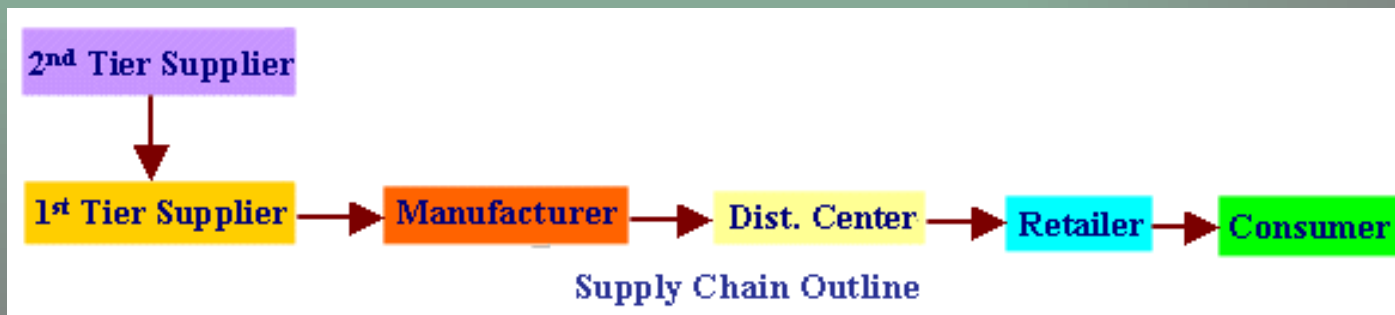
Supply Chain Management (SCM) entered the game play only in the last decade. However, the integrated SCM only began very recently.



What is a Supply Chain?

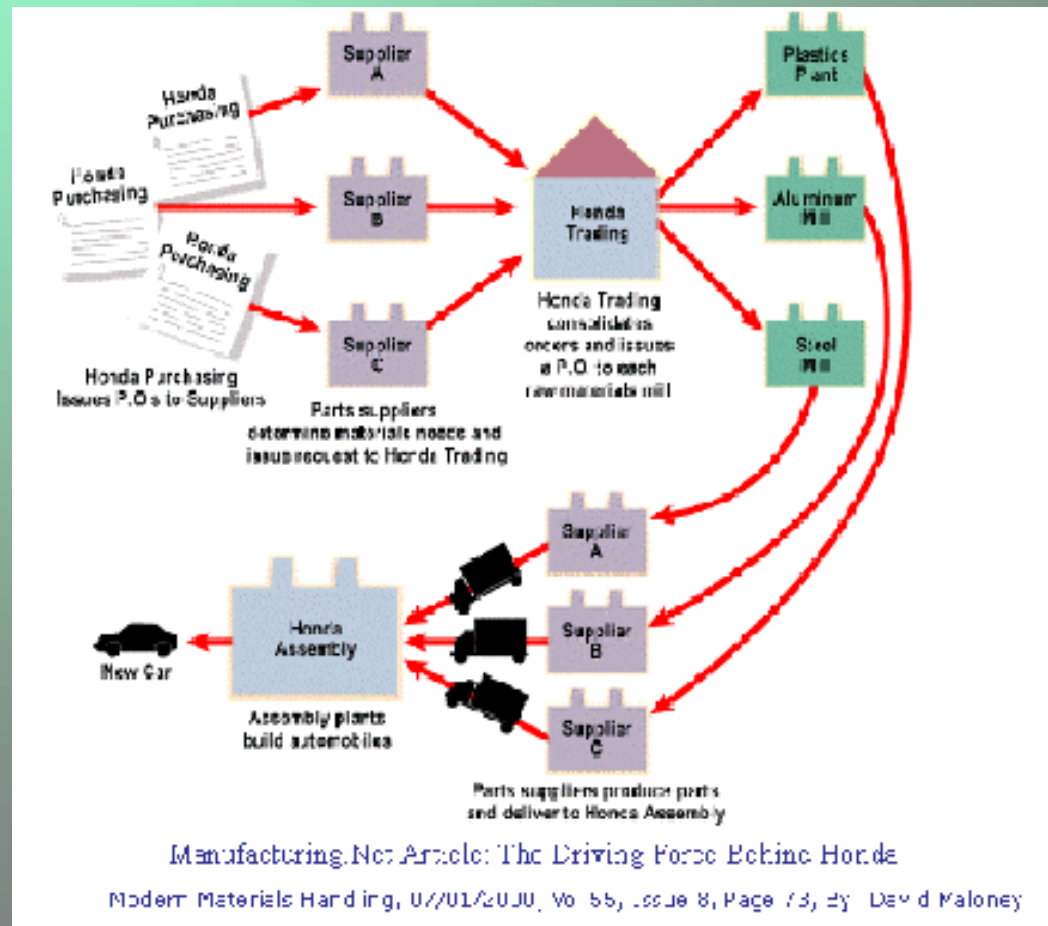
A supply chain encompasses all activities associated with the flow and transformation of goods from the raw materials stages (extraction), through to the end user.

Supply chain management (SCM) is the integration of these activities through **improved** supply chain relationship, to achieve a sustainable competitive advantage.



An Example of Supply Chain and SCM:

Honda Car Manufacturing



Three Primary Components of SCM

Information – A vital component for an SCM to be responsive to the market demand and for the supply chain to be competitive with others.

Logistics – The primary material flow and transformation activities in a supply chain, including e-procurement, design, supply of parts and materials, manufacturing, warehousing, and delivering.

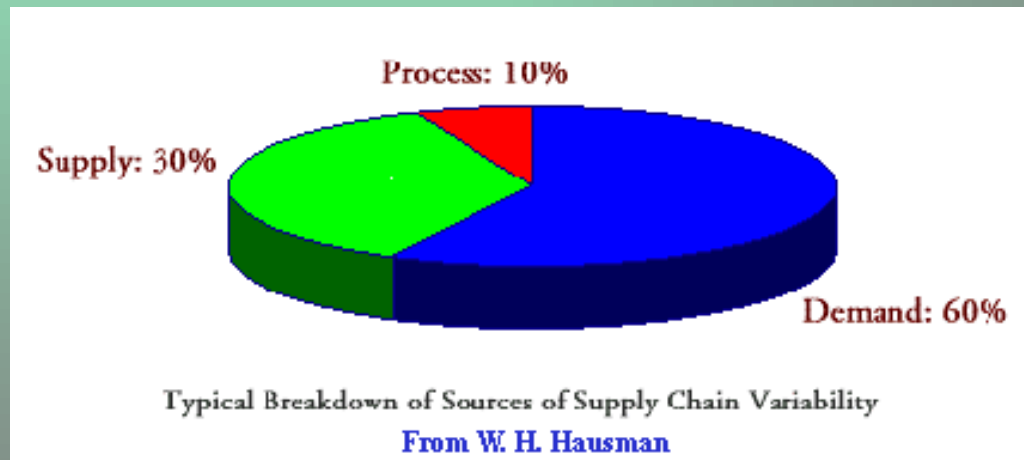
Finance – The primary finance transaction of a supply chain including pricing, invoicing, payment, and account transaction within supply chain, among others.

Information management and visibility are keys for a successful SCM!

Challenges to SCM

There are various challenges to the development of an effective SCM. The variability and uncertainty are the most significant threats to such an effort.

Such challenges are roughly coming from three aspects of an SCM in the following breakdown



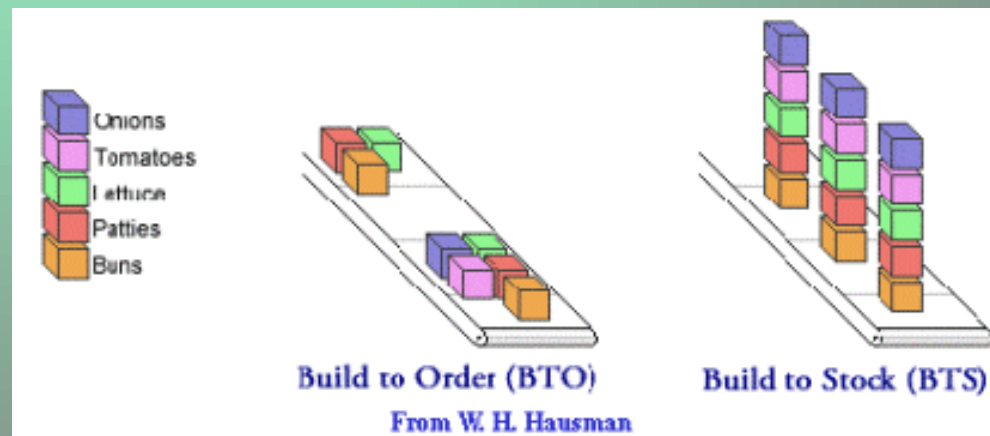
Thus, an efficient supplier relationship management system and strong algorithm in market forecasting would improve an SCM in large.

Push-Pull Point – An Important Issue That Cannot be Overlooked in SCM

Two models in business for market demand response:

Build-to-stock (BTS) – build for anticipated demand (push)

Build-to-order (BTO) – build for firm order (pull)

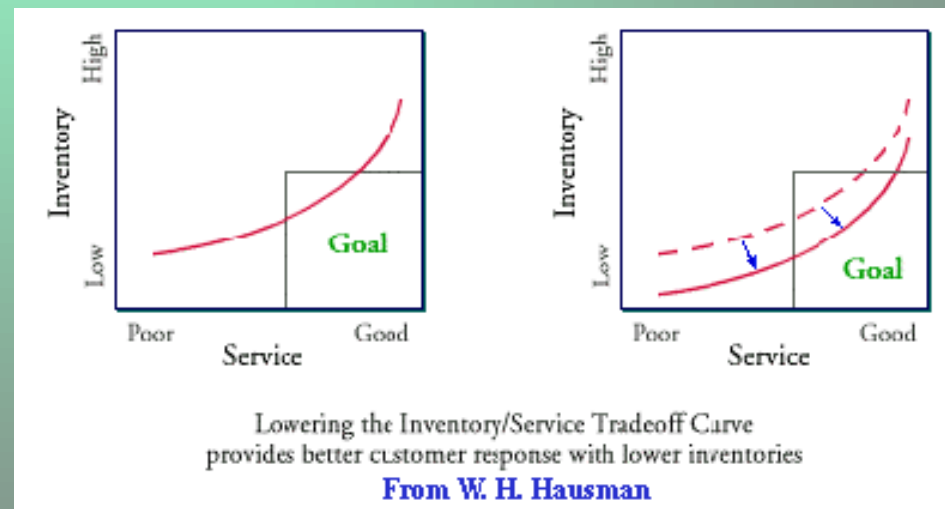


Where the chain switches from push (BTS) to pull (BTO) is called the Push-Pull point.

Well manage the push-pull point in an SCM will improve its performance.

Trade-off curves

One of the fundamental tradeoffs in supply chain management is between inventory levels and customer service.



One application for trade-off curves is to assess an SCM effectiveness and efficiency treating the supply chain as a whole.

Bullwhip Effect

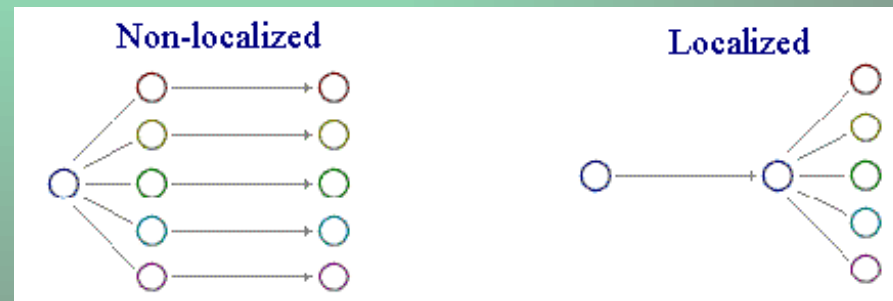
The Bullwhip Effect is a major cause of supply chain problems. It describes how small fluctuations in demand at the customer level are amplified as orders pass up the supply chain through distributors, manufacturers, and suppliers.

Common Causes for the Bullwhip

- Demand Signal Processing (each stage does its own forecasting)
- Order Batching (trying to achieve economies of scale)
- Price Fluctuations (inducements such as “ forward buys” through price reduction)
- Allocation Gaming (when shortages loom, over-orders are placed)

Localizing Product Customization

Localizing product customization is an efficient way to cut cost for logistics management. This is especially the case for warehousing/delivering management.



Localizing product customization consequently requires that product design should be normalized, unified, and generalized.

Internet/Information Technologies and SCM

A Framework for Internet Impact

Within an Enterprise	Better Cost, Speed, Accuracy, Communication
Across the Chain: Information Exchange	Visibility, Collaboration on Inventories and Design
Across the Chain: Restructuring	Compressing the Chain, Changing Roles; "Virtual Resources"
Across Multiple Chains or Nets	Auctions, e-Procurement, Exchanges, Communities
New Business Opportunities	New Channels/Markets, Mass Customization, Truly New Products

From W. H. Hausman

The Components of SCM in An Enterprise



Ordering Management System (OMS)

- Order receiving
- Validation (credit checking)
- Processing
- Prioritizing
- Invoicing

Design/Manufacturing Execution System (MES)

This part virtually consists of two sub-components: Design and MES

Design: Product design phase, will produce specifications of geometric and functional attributes and parts needed, in addition to the detailed product designing.

MES: Integrates the flow of materials and work-in-process (WIP) with the production process dynamically in real time, compensating for shifts in production machine availability, inventory levels, order priorities, and labor, balancing these with what's really happening on the shop floor, making on-the fly decisions.

Warehouse Management System (WMS)

Primary roles for this component are

- Inventory
- Order fulfillment
- Materials handling equipment management
- Space utilization management
- Labor utilization management

Transportation Management System (TMS)

Optimized transportation management in various modes along with associated activities

- Managing shipping units
- Labor planning and building
- Shipment scheduling through inbound, outbound, intra-company shipments
- Documentation management (especially when international shipping is involved)
- Third party logistics management

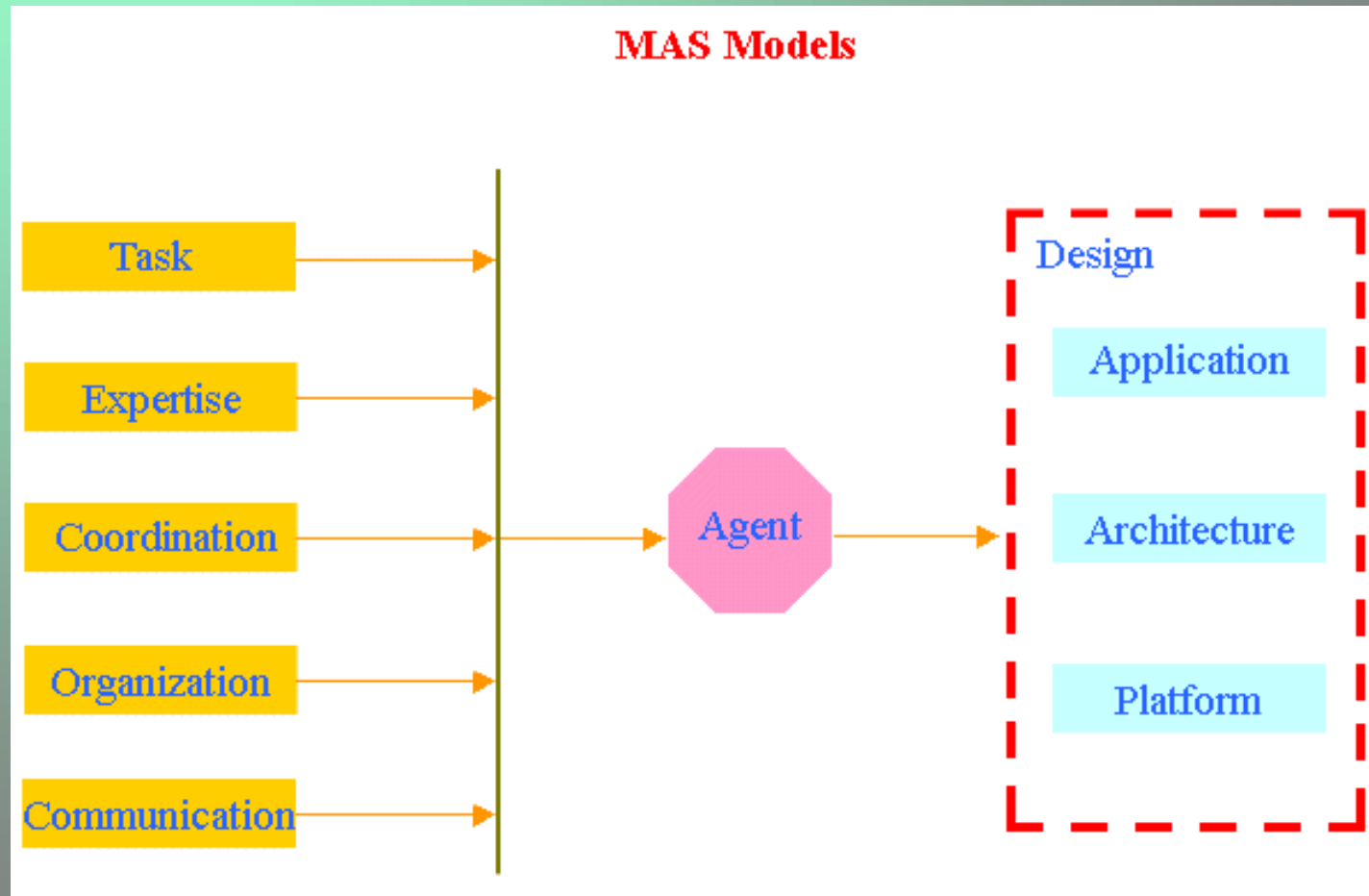
Design of SCM

Traditionally, objective-oriented system (OO) design has been the dominating trend in SCM.

Agent-oriented System (AO) design is being brought into the play for an effective and integrated SCM.

AO is considered as an extension of OO. However, agents are not simply objects.

A Multi-Agent System (MAS) Design – An Open System Approach



What do the models do?

Agent Model - Describes the main characteristics of the agents, including reasoning, skills, services, Goals, among others.

Task Model - Describes the tasks (goals) carried out by agents, and task decomposition.

Expertise Model - Describes the knowledge needed by the agents to carry out the tasks and distinguishes domain, task, inference and problem solving knowledge.

Coordination Model - Describes the conversation between agents, namely, their interactions, protocols, and required capabilities.

Organization Model - Describes the organization in which the MAS is to be introduced and the organization of the agent society.

Communication Model - Details the human-software agent interactions, and the human factors for developing these user interfaces.

Design Model

Collects the previous models and is subdivided into three sub-models:

Application design – Composition or decomposition of the agents of the analysis, according to pragmatic criteria and selection of the most suitable agent architecture for each agent.

Architecture design – Designing of the relevant aspects of the agent network: required network, knowledge and telematic facilities.

Platform design – Selection of the agent development platform for each agent architecture.

Localized Information Management for Global Goals through Local Agents Interaction

The most important global goals for any enterprise are to reduce cost and enhance marketing share or sales.

Means to achieve these:

- A working CRM system for improved sales or market occupation
- Efficient systems in an SCM at each link (efficient and effective information localization and utilization). This can be done through local agent interaction or conversation.
- Market-based control systems: coherent global goals can be achieved through relatively simple mechanism of local agents interaction.

Supply Chain Management as Complex System

Main system characteristics of SCM:

Dynamic System – real-time response to changing market demand

Decision Support System – planning, forecasting, and decision-making

Hierarchical System – hierarchical relationships determined by business nature

Complexity – numerous factors and complex relationships

Indeterministic – unpredictable factors

Main References

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