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Dipartimento di Ingegneria e Scienza dell'Informazione
Corso di Laurea in Ingegneria Informatica, delle
Comunicazioni ed Elettronica (ICE)

Organizzazione e Gestione Aziendale

La gestione strategica delle supply chain

Prof. Marco Formentini
Università degli Studi di Trento, 29 Maggio 2023

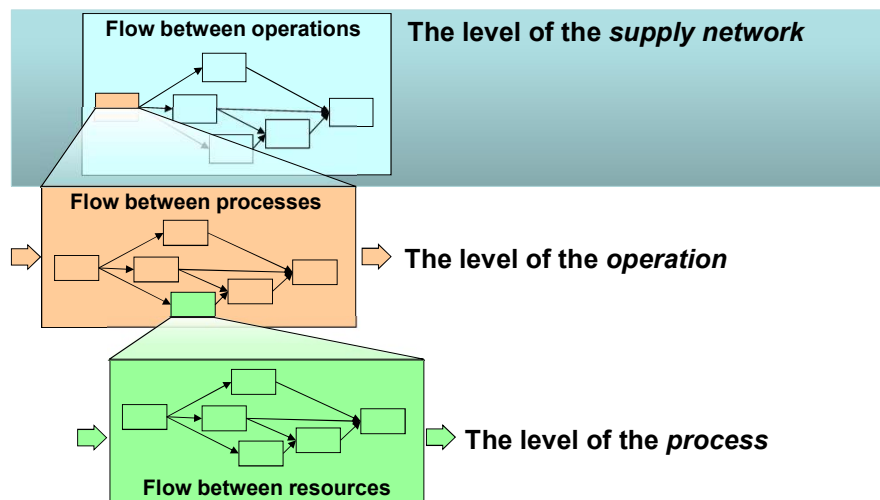
Agenda

- Introduction to supply chain management
- Supply chain strategy and dynamics
- Supply chain design: Fisher's model

Introduction to Supply Chain Management

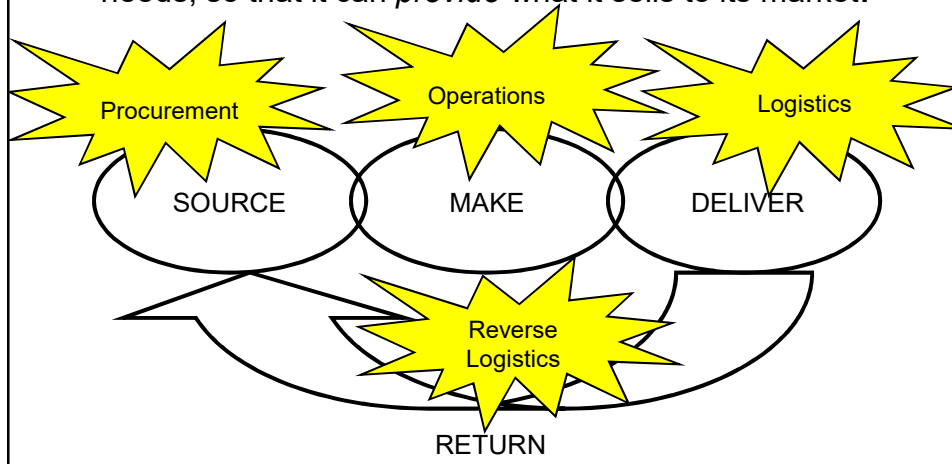


The process view at three levels of analysis



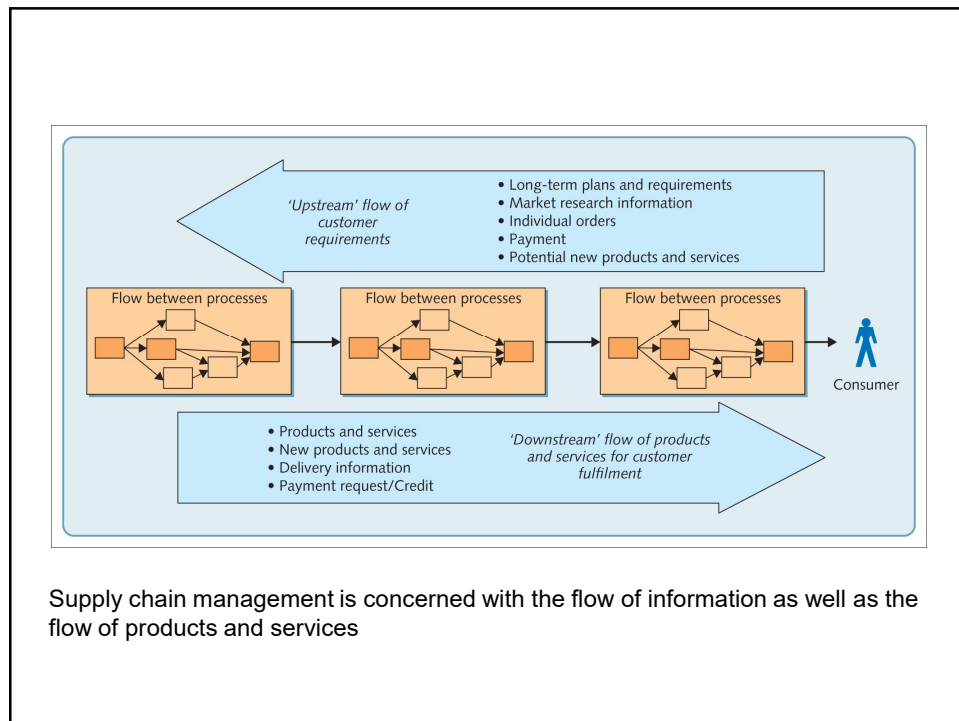
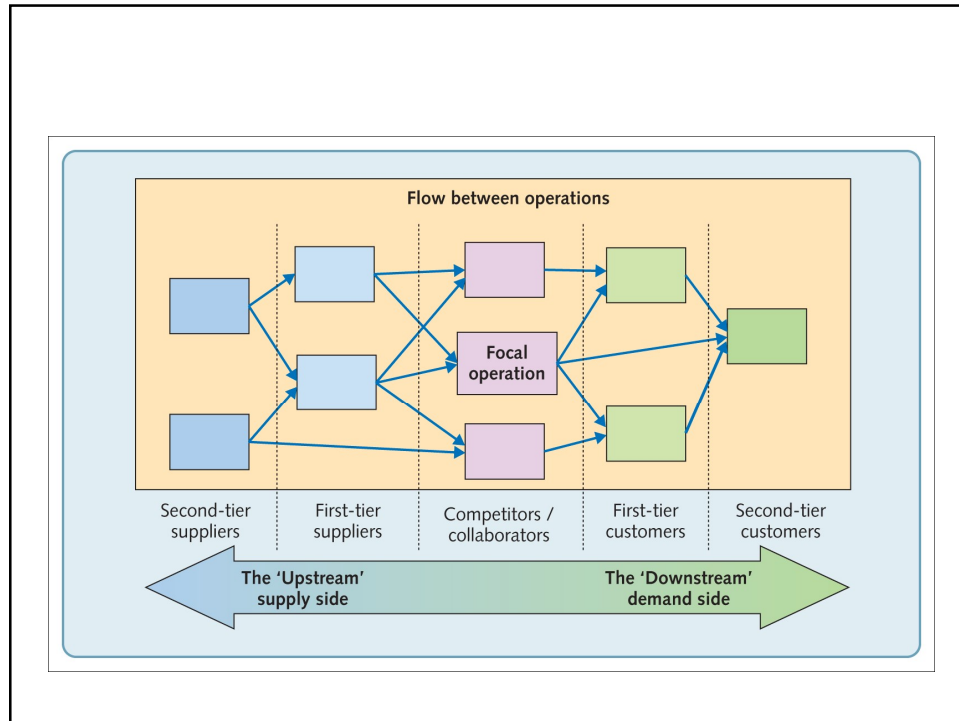
What is Supply Chain Management?

- Ensuring that the enterprise is *supplied* with what it needs, so that it can *provide* what it sells to its market.



What is a Supply Chain?

- “A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request” (Chopra and Meindl, 2004).
- Involving: manufacturer, suppliers, transporters, warehouses, retailers and customers.
- Flows of products, finances, information and services

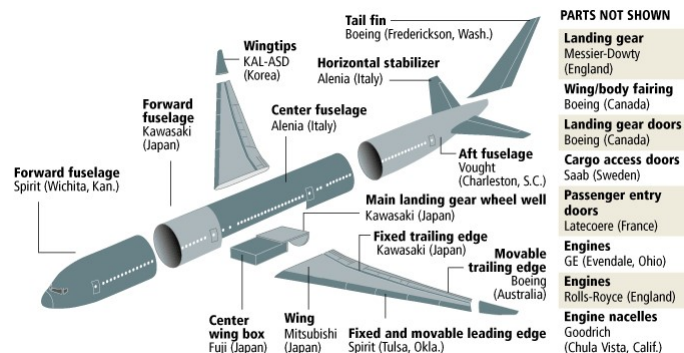


What Is the Goal of Supply Chain Management?

- Supply chain management is concerned with the **efficient integration** of suppliers, factories, warehouses and stores so that merchandise is produced and distributed:
 - In the right quantities
 - To the right locations
 - At the right time
- In order to
 - Minimize **total system** cost
 - Satisfy customer service requirements

However, this integration is complex, due to the complex nature of supply chains.

The 787 alone has about 2.3 million parts. Some, like the fuselage, are built by Boeing. Other components, such as the landing gear, are contracted out for a supplier to build. Boeing has a very thorough inspection process to ensure the highest quality on each part that comes into our factories.



Boeing has a relationship with 5,400 supplier factories, including sub-tier suppliers

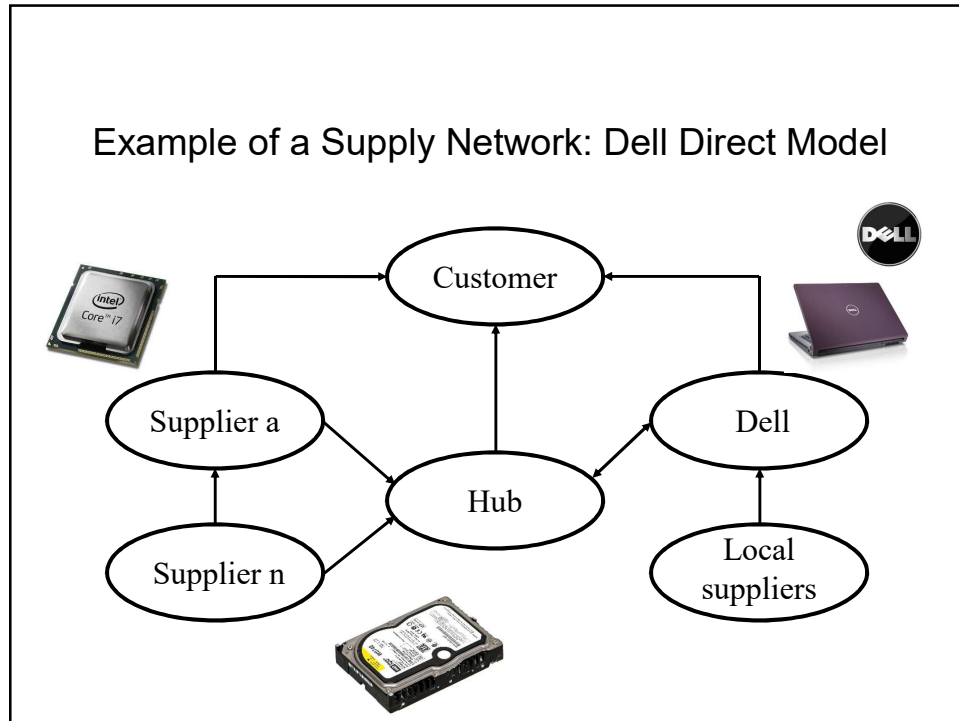
- More than 750 million components and assemblies were procured in 2012
- 500,000 people are employed through the Boeing supply chain

Key Supply Chain Outcomes



Adapted Melnyk et al. 2010





Challenges

- In comparison with other competitors lacks economies of scale
- Higher costs of local manufacturing
- Increasing complexity
- Falling corporate sales
- Need to enhance B2C
- Dell had to deal with all customer enquiries, not a cost centre
- Lack of innovation?

Supply Chain Management is a complex concept!



DELL'S FOUR SUPPLY CHAINS

Dell Inc. created four supply chains, each dedicated to a different customer segment, but all configured in such a way that the company could take advantage of synergies across the different supply chains.

	BUILD-TO-ORDER	BUILD-TO-PLAN	BUILD-TO-STOCK	BUILD-TO-SPEC
Customer Segment	Online/Low-Volume Configurations	Retail	Online/Popular Configurations	Corporate Clients
Products	Configuration defined by customers	Small number of configurations designed for market	Small number of configurations designed for market	Designed for customer
Production Batch Size	One	Large	Large	Large
Production Strategy	Assembly is driven by individual order	Smooth production to cut cost	Smooth production to cut cost	Quantity and schedule defined by customer order
Finished Goods Inventory	No	Yes (at retailer)	Yes (at Dell)	No
Lead Time	Short (air) to achieve responsiveness	Long (ocean) to reduce shipping cost	Long (ocean) from manufacturing to stocking locations and short (parcel) to customer locations	Long (ocean) to reduce shipping cost
Planning Horizon	Short	Long	Medium	Long

- Supply chain strategy and dynamics

Strategies for SCM

All of the advanced strategies, techniques,
and approaches for Supply Chain

Management focus on:

- Global Optimization
- Managing Uncertainty

Tools and Strategies for Optimization

- Decision Support Systems
- Inventory Control
- Network Design
- Design for Logistics
- Cross Docking

Why is Optimization Hard?

- The supply chain is complex
- Different facilities have conflicting objectives
- The supply chain is a dynamic system
 - The power structure changes (e.g. HTC)
- The system varies over time

Conflicting Objectives in the Supply Chain

1. Purchasing
 - Stable volume requirements
 - Flexible delivery time
 - Little variation in mix
 - Large quantities
2. Manufacturing
 - Long run production
 - High quality
 - High productivity
 - Low production cost

Conflicting Objectives in the Supply Chain

- 3. Warehousing
 - Low inventory
 - Reduced transportation costs
 - Quick replenishment capability
- 4. Customers
 - Short order lead time
 - High in stock
 - Enormous variety of products
 - Low prices

Tools and Approaches for Global Optimization

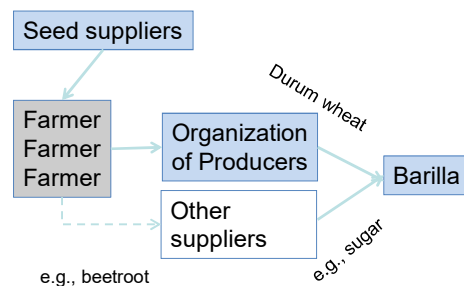
- Everything for optimization, plus...
- Strategic Alliances/Supplier Partnerships
- Supply Contracts/Incentive Schemes

VMIs



Barilla's sustainability goals

- 2020 goals
 - Double the turnover
 - Reduce CO₂ in the supply chain by 50%
- Taking an 'integrated' approach for its procurement
- DSS
- Supply chain contracts



Uncertainty

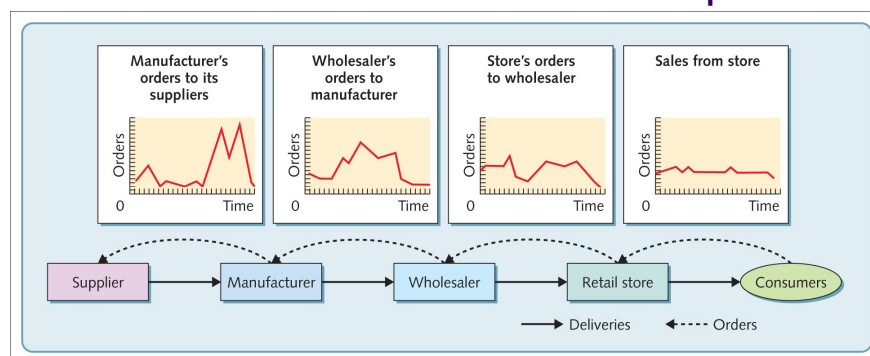
- What is variation?
- What is randomness?
- What tools and approaches help us to deal with these issues?

Why Is Uncertainty Hard to Deal With?

- Matching supply and demand is difficult.
- Forecasting does not solve completely the problem.
- Inventory and back-order levels typically fluctuate widely across the supply chain.
- Demand is not the only source of uncertainty:
 - Lead times
 - Yields
 - Transportation times
 - Natural Disasters
 - Component Availability

Order Variability is amplified up the supply chain; upstream echelons face higher variability and 'demand distortion'.

Bullwhip effect



- ➔ Critical role of information to avoid this effect
- ➔ Supply Chain Integration

Bullwhip Effect

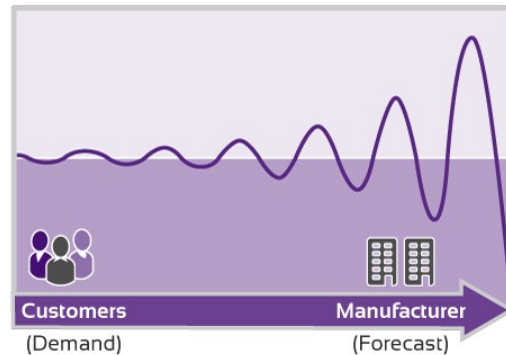
- ◎ Bullwhip refers to the scenario where the orders to the supplier tend to have larger fluctuations than sales to the buyer and the distortion propagates up a supply chain in an amplified form.

Like the « butterfly effect »

The effect of a little variation is amplified from the downside to the upside = BULLWHIP EFFECT



Bullwhip Effect: basics



Therefore it can be said that the bullwhip effect is an *inefficiency of the supply chain*: small changes in customer demand can result in large swings in orders placed upstream.

Effects on performance of the Bullwhip

- Total profit level are lowered
- Manufacturing costs are increased. Manufacturer respond to variability by building excess capacity or holding excess inventory.
- Inventory costs are increased.
- Replenishment lead times are increased. Variability makes scheduling more difficult, and current capacity + available stock cannot cover current orders (shortage).
- Transportation costs are increased. Surplus transportation capacity i required in case of high variability.

Counter Measures to Bullwhip effect (1/2)

◎ **E-commerce and the Internet**

- allow upstream parties, e.g., suppliers, to have access to more accurate demand information. It mitigates the bullwhip effect by preventing distortion and miscommunication of demand information, and reducing the lead time in order processing.

◎ **Express delivery**

- reduces lead times, and the associated demand variance.

◎ **Collaborative forecasts**

- help all stakeholders in the supply chain to arrive at a common, agreed-upon forecast of end-customer demand and reduce the bullwhip effect.

Counter Measures to Bullwhip effect (2/2)

◎ **Vendor-managed inventory**

- allows the supplier to monitor downstream demand and to make a well-informed decision about how much to keep on-hand and how much to ship to its customers. Thus, the supplier does not have to rely on order data to forecast demand and thus reduce the bullwhip effect.

◎ **Supply contracts**

- align incentives in the supply chain, and reduce the uncertainty in demand by determining agreed-upon supply limits, thereby reducing the bullwhip effect.

Dealing with Uncertainty

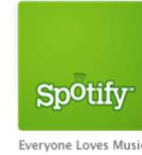
- Pull Systems – ‘demand driven’, no forecasts
- Risk Pooling – aggregate demand
- Centralization
- Postponement – delayed product differentiation
- Strategic Alliances
- Collaborative Forecasting

What's New?

- Global competition
- Offshoring & re-shoring
- Shorter product life cycle
- New, low-cost distribution channels
- More powerful well-informed customers
- Internet and E-Business strategies
- Sustainability & Reverse SCs

Think about these products/services in terms of:

- Product/Service lifecycle
- Profit margins
- 4 V's



Nature of Product/Service

Remembering the Apple Newton's Prophetic Failure and Lasting Impact

BY MAT HONAN 08.05.13 6:30 AM



HOME > TECHNOLOGY > APPLE > IPHONE

Hundreds of Apple fans queue outside stores for new iPhone 6s

The new iPhone 6s and iPhone 6s Plus have gone on sale, with queues snaking around the Apple store in London's Covent Garden and in other countries



"At the time, it was extremely difficult to get component manufacturers to build any sort of custom parts."

Nature of Product/Service

Apple suppliers expect iPhone 6s orders to be cut by 30% this quarter - report

By Neil Hughes
Tuesday, January 05, 2016, 11:18 am PT (02:18 pm ET)

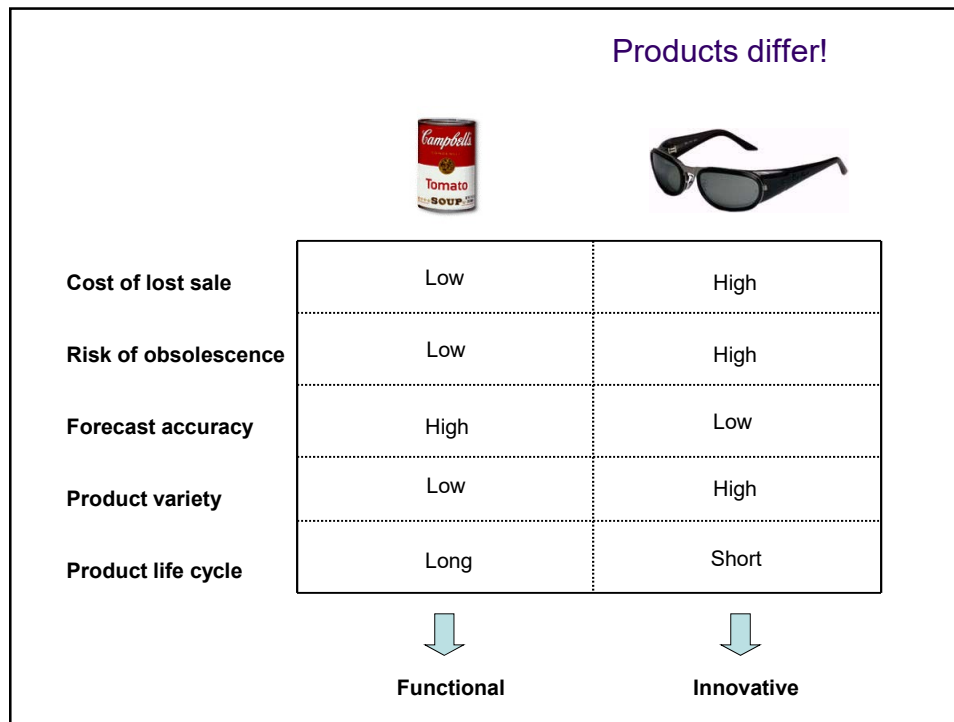
Apple suppliers are preparing for slower-than-expected sales of the iPhone 6s and 6s Plus in the current March quarter, with orders said to be some 30 percent lower than originally expected, according to Japanese business newspaper Nikkei.



<http://appleinsider.com/articles/16/01/05/apple-suppliers-expect-iphone-6s-orders-to-be-cut-by-30-this-quarter---report>

Nature of Product/Service

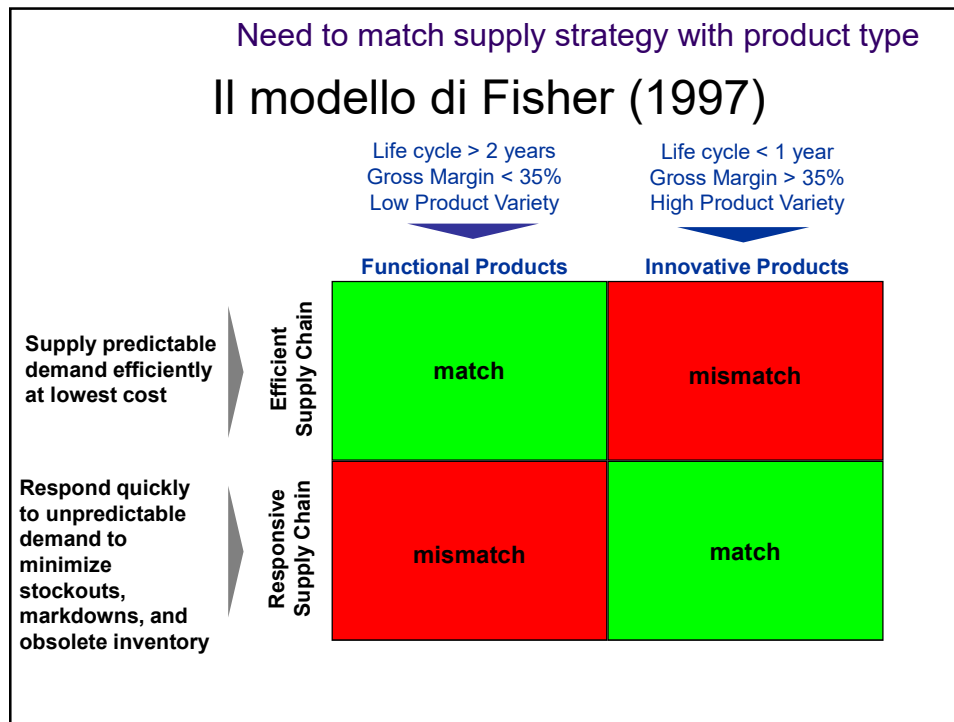




...and supply strategies differ!

Il modello di Fisher (1997)

	PHYSICALLY EFFICIENT PROCESS (Lean)	MARKET RESPONSIVE PROCESS (Agile)
SUPPLY OBJECTIVE	Efficiency Lowest possible cost	Quick response
INVENTORY STRATEGY	High turns Minimise inventory	Significant buffer stocks of components and FGs Postponement
LEAD-TIME	Reduce if doesn't increase cost	Aggressively reduce
SUPPLIER SELECTION	Cost	Speed, flexibility
PRODUCT DESIGN	Integral for max performance at min cost	Modular to enable postponed differentiation



What does a lean supply chain look like?

- JIT (Just In Time)
- Basic contracts – relational elements & Lean Supply
- Sourcing decisions based on total cost, not price
- A trend to local sourcing
- Supply base reduction
- Shortest Supply Chain possible
- “Pull” not “push”

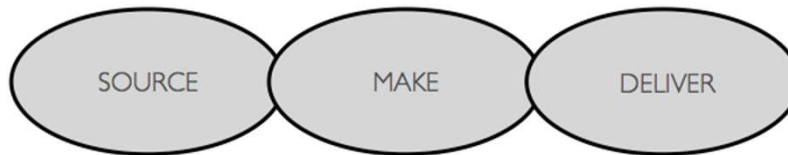
Some Challenges

- JIT requires frequent deliveries
 - How does this sit with low cost, global suppliers?
- Green issues
- The need for level scheduling - more responsiveness required?
- More open to disruption?

Agile Supply Chains

- *“Respond quickly to sudden changes in supply or demand. They handle external disruptions smoothly and cost-efficiently.” (Lee, 2007)*
- Key concepts:
 - Speed = Lead-time
 - Flexibility = Range and Response

Pathways to Agility



Supply Side Factors:

- Spatial Integration
- Leverage partner's capabilities
- Inventory buffers
- Dependable logistics system or partner(s)
- Contingency planning
- Information flows

Operational Factors:

- Reduce non-value adding time
- Manufacturing flexibility
- Inventory
- Product architecture
- Postponement

Demand Factors:

- Demand anticipation
- Information integration
- ICT enablers
- Market sensitivity
- Capture emerging trends

Lean and Agile: conclusions

- There are natural matches between the characteristics of products/services and supply chain design
 - Functional = Lean
 - Innovative = Agile
- Lean and agile can be combined through the use of postponement, modularity and platforms

Key Learning Outcomes

- Background to SCM
- Supply chain optimization
- Managing uncertainty
- Supply chain design: Lean vs. Agile