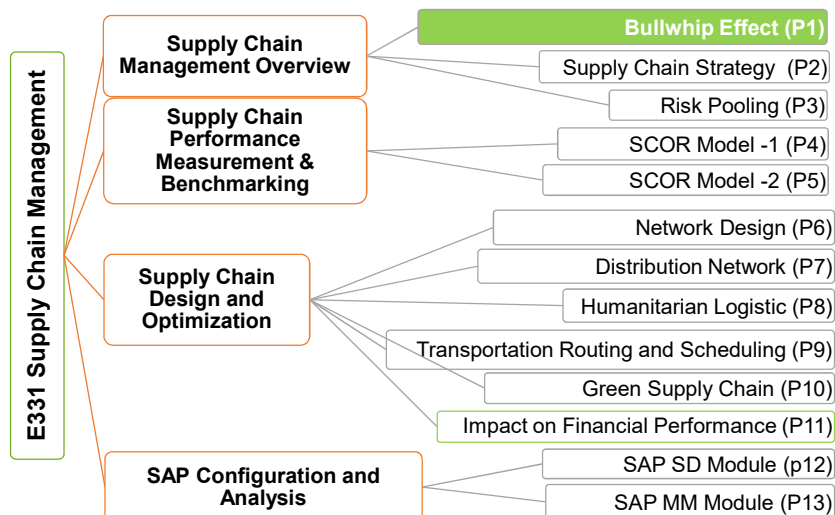


P01: Supply Chain Challenge

E331 Supply Chain Management

Diploma in Supply Chain Management (DSCM)

E331 Module Overview



What is a Supply Chain?



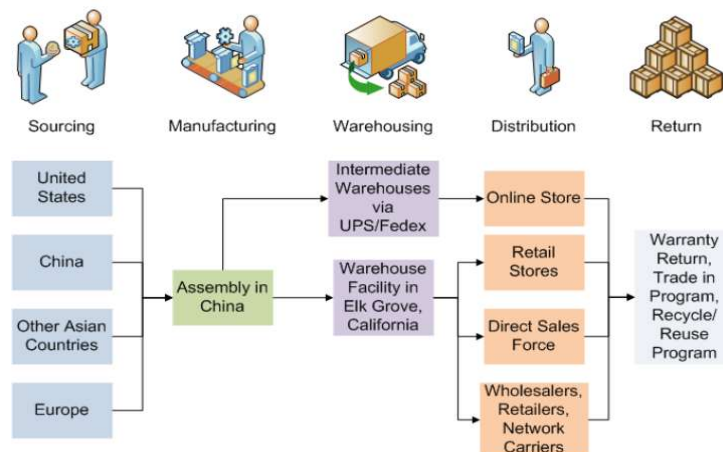
- A supply of products and services to end-customers through a chain of:
 - Raw materials suppliers
 - Parts manufacturers
 - Finished product manufacturers
 - Wholesalers and distributors
 - Retailers
- Connected by transportation and storage services
- Integrated with information flow & planning activities
- Consideration on related costs and service levels



A Complex Supply Chain

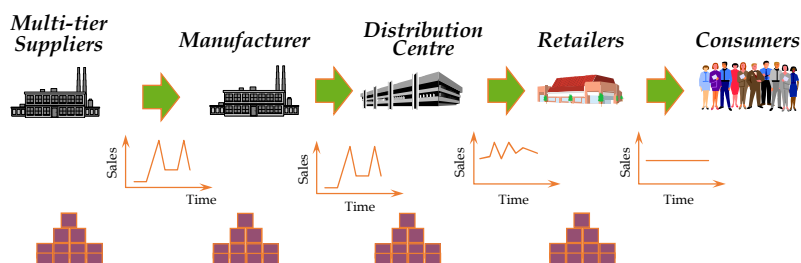


An example of electronic product's supply chain



How do you manage such end to end supply chain?

Supply Chain Management



- Supply chain management (SCM) is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and retailers, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while fulfilling service level agreement.

The Bullwhip Effect



- In early 1990s, P&G faced a problem of extreme demands variation for its Pampers diapers.
- Although the purchase rate remains steady at the customer end, the variation of orders amplify up the supply chain, from the retailer level to the distributor level. This phenomenon is called bullwhip effect.
- The distorted information from one end to the other end of a supply chain can lead to tremendous inefficiencies, such as excessive inventory investment, poor customer service, lost revenues and inaccurate production schedules, etc.
- In learning supply chain management, the most classical beer game has been used to demonstrate this phenomenon.

Observations from the Beer Game



- Customer demand spiked up in week 4, this resulted in a shortage at the retailer side
- The retailer ordered more root beer. In the meantime, the retailer inventory decreased and then dropped to zero, followed by a growing backlog.
- In view of the increased orders, each upstream partner exhibited the same behavior, increasing the backlog at every stage in the chain.
- The factory began producing higher amount to catchup with orders, around week 15 onwards.
- Around week 20, the factory is able to fill its backlog and ship to the distributor. As each partner received inventory, it shipped to its downstream partner.
- Due to the large backlog of orders, each stage of chain ships and ships. Inventory keeps building higher and higher. Instead of shortages, the entire supply chain now has a massive overflow of inventory.

Backlog Costs Correspond to...

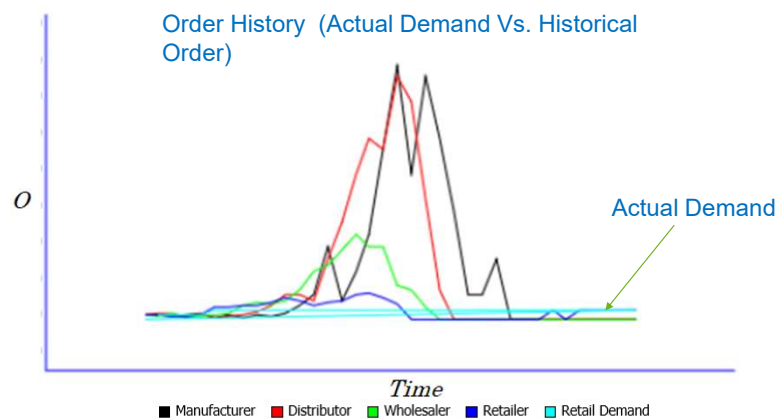


- Expediting; special shipping and handling expenses
- Rush production, like OT. Manufacturing costs may also include changeover costs (workers switch over from producing one order to another)
- Poor customer service – increasing lead times cause unhappy customers
- Lower revenue – opportunity cost of lost sales
- Excessive inventory (in reaction) – higher carrying costs
- Product quality – irregular production schedules challenge regular quality control routines
- Excessive capacities (in reaction) – all stages of the supply chain may invest in warehouse and plant capacity to produce or carry extra inventory

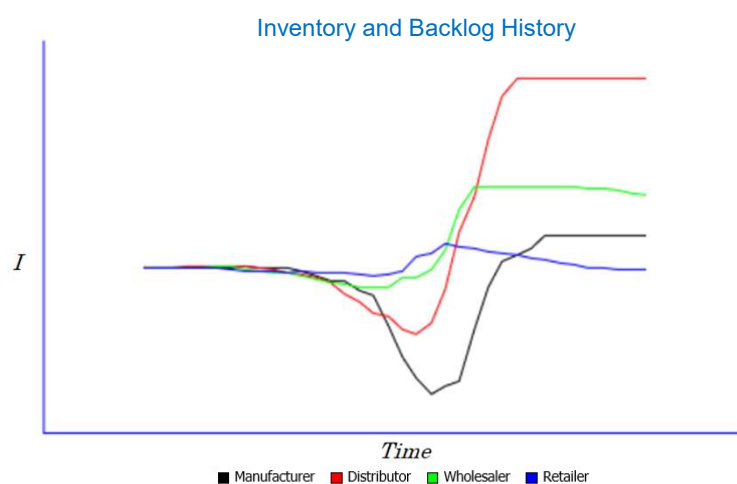
1st Round Game Results: What Happened?



- What do you think contributed to the high level of **backlog** across-the-board?
- What do you think contributed to the excessive accumulation of **inventory** across-the-board?



Typical Results: Inventory & Backlog



Chain Results Analysis



Three key patterns emerged:

- **Oscillation:** first backlog, then excessive inventory in the entire chain
- **Amplification:** height of oscillations (and hence costs) increases the farther away one is from the end customer
- **Lag:** order peaks are delayed a few weeks each step down the supply chain
- Everyone ordered zero or very little by the end of the game and struggled to get rid of the inventory.

Why Did These Happen?



These patterns occur with every single team/supply chain, so what are the root causes?

- Over reacting to the backlog orders
- No communication, leading to independent and conflicting decisions
- Delay times between order processing, demand, and receipt of products.
- “Black box” observing patterns - Inaccurate demand forecasts purely based on orders received from downstream player

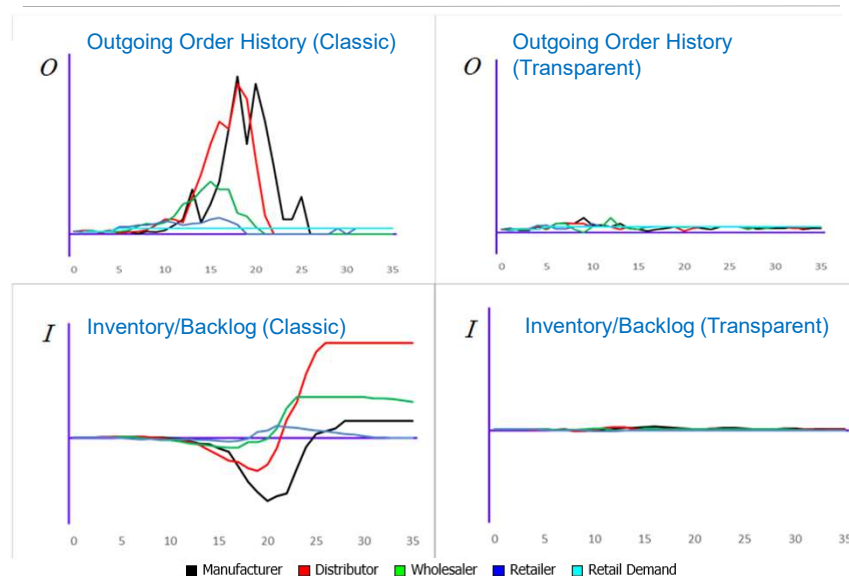
Cracking the Bullwhip Effect



- The essence of the Bullwhip Effect is that orders to suppliers tend to have larger variance than sales to the buyer.
- The more chains in the supply chain the more complex this issue becomes.
- **Lead time** is the key problem, the longer the lead time, the more significant the bullwhip effect
 - What caused lead time?
 - ✓ Transportation (delivery lead time)
 - Land transportation, Sea Cargo, Air Cargo, Inter-modal
 - ✓ Data Processing (ordering lead time)
 - ERP, EDI, Internet, Bar-code scanning, etc.
- **Information Sharing** is another problem
 - The order patterns seen at upstream stages are distorted by their direct downstream stage
 - Transparency of information is the key to solve the issue



Game Results: Scenario Comparison



Summary from the Beer Game (I)



- The basic dilemma arising from the Root Beer Game
→ how can supply chain participants better match supply and demand?
- Real supply chains are more complex:
 - Each player has a network of partners
 - Each player may perform more than one role
 - Relationships are dynamic
- To minimize the Bullwhip Effect, it is best to change the supply chain system → both the structural changes and information communication changes

Summary from the Beer Game (II)



- In the real world, it is not enough to communicate facts such as POS data, materials management strategies and inventory positions should also be shared to come up with an agreement on how the system will be run. Supply chain players must agree to forecast demand together and develop a procedure for handling week-to-week fluctuations.
- In general, structural changes to supply chain that reduce lead times are more effective in reducing amplitude than changes in demand forecasting methods.

Summary from Root Beer Game (III)



- An alternative and better solution is to let one supply chain player control the movement of goods and to transfer decision rights to that player.
- In a traditional supply chain, the distributor (buyers) retains total control of the timing and size of orders being placed to the manufacturer (supplier).
- By contrast, with VMI (vendor managed inventory), the manufacturer monitors inventory levels of the distributors and actual sales data electronically or through physical monitoring. Based on this information, instead of responding to orders, the manufacturer periodically decides when and how much to replenish the distributor's inventory.

Why Supply Chain Management?



- Through the beer game, we learned that supply chain management is:
 - Inventory management
 - Forecasting and planning
 - Logistics Transportation
 - IT system (data processing and information sharing)
 - Collaboration among players (Alliances)
 - Meet the target: Minimizing total cost (performance measurement)
 - And many more
- This highly simplified exercise allows us to start thinking about business strategies that may provide a better and effective supply chain management.

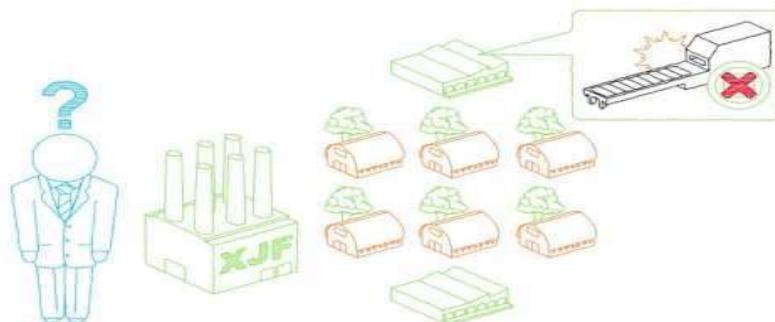


P&G's Case



- Procter & Gamble set up “**control towers**” to help manage its supply chain networks in emerging markets in Eastern Europe, the Middle East, and Africa.
- In supply chain, a control tower is a mean that provides **visibility** into inbound and outbound distribution flows, much like an air traffic control tower that coordinates the movement of aircraft flying in and out of an airport.
- Although a number of companies in Europe have adopted the control tower concept, P&G's case is particularly interesting because their executives believe that this approach will help them control distribution costs and manage supply flows into the emerging markets.

Video: Importance of Supply Chain Visibility



<https://www.youtube.com/watch?v=qhn9gpOf8uQ>

What is Supply Chain Control Tower?



- What if the supply chains could remove all information delay and operate in **real time** for decision making?
 - Responses to customer inquiries on the spot.
 - Questions are answered in minutes, not hours/days
- Supply chain leaders have always been trying to remove as much latency as possible in every aspect of the supply chain
- Supply Chain Control Towers have the potential to make this possibility come alive!

Concepts of Supply Chain Control Tower



- The essence of the control tower concept is to provide supply chain **visibility** across divisions, countries, etc.
- It provides a **centralized** and **standardized** control mechanism for **proactively** managing, executing, and reporting “events” in the supply chain.
- It is not actually a physical tower
- It is not in direct communication with truck drivers, captains or pilots
- It does not control the production, storage, replenishment and order processes, etc.

Features of Supply Chain Control Tower

- The heart of the control tower is an information hub supported by a set of detailed **decision-making rules** and a trained team of operators.
- This central information hub **gathers** and **integrates** data from a variety of sources and subsequently distributes it in a **consistent** format.
- This integrated overview allows the control tower operator to **detect risks or opportunities** at an earlier stage.
- It is just a new layer of technology on top of all the existing systems to provide the linkage for **visibility**, **analytics** and what if **simulations** that will complement and better leverage them to generate differentiated values.

Benefits of Supply Chain Control Tower

- End-to-end visibility or data transparency allows for better understanding of the entire supply chain and logistic processes
- Real time data available for better, quicker and more informed business decision making
- Improved demand planning, scheduling and delivery times
- Increased customer satisfaction and brand reputation
- Improved productivity and efficiency
- Reduced operating and transportation costs

Challenges on Implementation



- Require strategic studies and decision on its location, especially for global business or companies that may need more than one control tower round the clock to support business globally.
- Require standardization of business processes and this means removing local customization in countries.
- Data availability and transparency can be difficult for global companies which may have different legacy data formats from different partners, in different regions and countries.
- Conflicting performance measurements or lack of it. For global supply chains, different regions may have different business performance goals and objectives suited to local business environment.

Challenges on Implementation



- Roles must be clear and convincing or there will be resistance to change.
- Training on new processes must be provided.
- Those involved have no idea on how to actually create and implement a Control Tower.
- The transactions between parties must be electronic; and there must really be electronic tracking of inbound goods, goods in process, and outbound goods.
- Getting access to data in partner's operation can be a daunting prospect as you have to establish trust and transparency. Doing this with a handful of suppliers and carriers can be challenging. Doing it with hundreds of suppliers is a huge task.

Software for Supply Chain Visibility



Key Features:

- Track products at various stages (shipping, in transit, delivery etc.)
- Automate operations across the entire supply chain
- Improve product fulfillment and reduce lead times
- Optimize the use of products through reallocation
- Monitor supplier and carrier performance
- Find the optimal transportation model at the best price
- Identify and address transportation disruptions
- Manage the documents required for transportation
- Analyze the efficiency of supply chain activities

The Impact from Internet of Things (IoT)

- IoT comprises of small devices with active or passive connection to the internet
- Such devices can be attached to the product, much like barcode, and enable near real time information exchange
- Transaction or event data related to the product can be captured or transmitted constantly through the internet cloud
- This enhances data visibility, availability and timeliness which helps businesses react or make better decision quickly for any situation arises in the product supply chain

The Potential of Blockchain



- Blockchain is a database that records digital transactions in secured and transparent way
- It is often championed as a way to achieve supply chain transparency, due to three major characteristics:
 - ✓ Blockchains are public
 - ✓ Blockchains are decentralized
 - ✓ Blockchain is secure
- Blockchain has an important role to play in achieving transparent supply chains and ensuring customers understand where their products come from.

The Rise of Artificial Intelligence (AI)



- With the right digital foundation in place, companies can easily capture, analyze, integrate, access, and interpret high quality, real-time supply chain data.
- Many have used artificial intelligence to digitize and automate labor-intensive, repetitive tasks and processes such as purchasing, invoicing, accounts payable, and parts of customer service.
- Predictive analytics are helping companies improve demand forecasting, so they can reduce or better manage volatility, increase asset utilization, and provide customer convenience at optimized cost.
- Machine and deep learning technologies that may soon replace decision making in supply chain management.

Learning Objectives

- Recognize the Bullwhip Effect through root beer simulation game
- List the main factors that contribute to the Bullwhip Effect in a supply chain
- Apply techniques for controlling the Bullwhip Effect
- Appreciate the importance of supply chain management
- Appreciate the concept behind a control tower operations and how it supports the complex supply chain management and helps to eliminate the Bullwhip Effect

