Managing Complexity in the Supply Chain

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Much of the cost in today’s supply chains is there because of the continuing increase in their complexity .... it can be argued that perhaps the biggest opportunity for cost reduction lies in reducing that complexity.
“Complex is the opposite of independent whereas complicated is the opposite of simple.”

“Complex systems theory studies how relationships between parts give rise to the collective behaviours of a system and how the system interacts and forms relationships with its environment.”

The roots of complexity

- Outsourcing of non-core activities
- The globalisation of supply chains
- Increasing demands of customers
- Shortening life cycles
- Organisational growth through mergers and acquisition
Seven types of supply chain complexity

- Network complexity e.g. too many nodes and links
- Process complexity e.g. too many steps
- Range complexity e.g. too wide a range
- Product complexity e.g. too many unique components
- Customer complexity e.g. too many service options
- Supplier complexity e.g. too many suppliers
- Organisational complexity e.g. too many levels and ‘silos’
Complexity in the global supply chain: the Boeing 787

The Companies:

- **U.S.**
  - Boeing
  - Spirit
  - Vought
  - GE
  - Goodrich

- **Canada**
  - Boeing

- **Australia**
  - Boeing

- **Japan**
  - Kawasaki
  - Mitsubishi
  - Fuji

- **Korea**
  - KAL-ASD

- **Europe**
  - Messier-Dowty
  - Rolls-Royce
  - Latécoère
  - Alenia
  - Saab

The diagram illustrates the distribution of components across different manufacturing locations:

- **Wing Tips**
  - Korea

- **Movable Trailing Edge**
  - Australia

- **Tail Fin**
  - Fredrickson, Washington

- **Passenger Entry Doors**
  - France

- **Fixed Trailing Edge**
  - Nagoya, Japan

- **Engine Nacelles**
  - Chula Vista, CA

- **Center Fuselage**
  - Grottaglie, Italy

- **Forward Fuselage**
  - Nagoya, Japan

- **Forward Fuselage**
  - Wichita, Kansas

- **Cargo/Access Doors**
  - Sweden

- **Wing/Body Fairing**
  - Landing Gear Doors
  - Winnipeg, Canada

- **Main Landing Gear Wheel Well**
  - Nagoya, Japan

- **Center Wing Box**
  - Nagoya, Japan

- **Landing Gear**
  - Gloucester, UK

- **Fixed and Movable Leading Edge**
  - Tulsa, Oklahoma
Continued trends to off-shore sourcing and focused factories bring reduced costs to purchase/manufacture but ...........

........... have the potential to increase total supply chain costs and to reduce agility.
Understanding the total costs of ownership

Not just the purchase price, but .....

- Increased transport costs
- Increased inventory financing costs
- Increased uncertainty of supply
- Longer lead-times
- Less visibility and increased likelihood of “bullwhip” effect
- Loss of control in quality
- Longer development cycles for new products
- Increased exposure to security risks

..................... etc
What is the cost of Variety?

% of Revenue

100%

100%

% of Products

Volatility

High / unstable

medium / difficult

low / manageable

'A' Class Items
20% of the range
80% of the revenue
High average rate of sale

'B' Class Items
30% of the range
15% of the revenue
Medium average rate of sale

'C' Class Items
50% of the range
5% of the revenue
Low average rate of sale
Margin contribution / erosion in the supply chain is never uniform – some customers and products erode profit.

Several products / outlets produce a loss, even on a variable cost basis.

A few important products / outlets make a disproportionate contribution to profit.

At this level, the same profit is generated with considerably less effort.

At this level, total profit would be much higher than it is now.

The focus should be on:
1. Shifting the curve up
2. Re-designing or eliminating the tail

Cumulative Percentage of Contribution

Cumulative Percentage of Products / Outlets

Contribution delta potential
Products and customers combine to add more complexity.
Reducing organisational complexity

- Deep customer insight to identify the things that customers value – the ‘order winning criteria’
- Manage processes, not just functions
- Align these processes against the company’s value proposition
- Make cross-functional process teams the engine of the business
- Use appropriate KPIs to ensure that complexity reduction is a business priority
At Motorola, competitive pressure caused the company to extend its range of mobile telephones. However, often there was little commonality of parts across the range. For a single product, there could be over 100 possible configurations, i.e., four different colours and thirty software choices. Furthermore, these product variations were made ahead of demand to a forecast that was only accurate 3% of the time! To address this problem, Motorola devised a ‘Complexity Index’ for each product which included the number of components, the degree of commonality, lead-time of supply, and so on. New product ideas with high scores on the Complexity Index tend not to be proceeded with. As a result of this focus on complexity reduction, Motorola was able to significantly reduce its costs and improve its responsiveness.
Complexity drives cost

Much of the total life cost of a product is pre-determined at the design stage, e.g.:

- Number of components/materials
- Degree of commonality of components/materials across the product portfolio
- Lead-time of replenishment of components/materials
- Physical characteristics of the product
- etc ...
Farmers in Zentsuji, southwest Japan, preparing to pack square watermelons before shipment in refrigeration units. A farmer came up with the idea of optimising transport space and the melons are formed in square glass containers.