Global Supply Chain Strategies

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Faculty of Economics, Chiang Mai University
Lecture Outline

- Background
- Applying ‘lean’ and ‘agile’ or ‘leagile’ principles
- Outsourcing strategies
- Case 1: Marks and Spencer
- Case 2: Griffin Manufacturing
- Conclusions
What you should know

- The importance of **matching supply chains to customer demand**
- That "**one size doesn’t fit all**"
- **Lean, agile and leagile**
- Today we are going to apply this within the context of international supply chains
Figure 5.4 The agile supply chain

Source: Adapted from Harrison, A., Christopher, M. and van Hoek, R., Creating the Agile Supply Chain, Chartered Institute of Logistics and Transport, 1999
Figure 5.6 The reorder point method of stock control

- Stock level
- Average lead-time demand
- Reorder quantity
- Reorder point
- Lead time
- Safety stock

Order placed
Order arrives
Time
Determining the economic order quantity

- Total cost
- Inventory carrying cost
- Ordering/set-up cost

Cost vs. Quantity graph with EOQ (Economic Order Quantity) point.
The EOQ can be easily determined by the formula:

$$\text{EOQ} = \sqrt{\frac{2AS}{i}}$$

where,

- $A$ = annual usage
- $S$ = ordering cost/set-up cost
- $i$ = inventory carrying cost
Figure 5.11 Inventory hides the problems
Figure 5.11  Inventory hides the problems
Pipeline Types

Christopher et al. (2006)
## Pipeline Types

### Demand Characteristics

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### Supply Characteristics

- Christopher et al. (2006)
Group Exercise
(10 minutes each task)

- For each of the quadrants:
  1. **Decide which supply chain strategy is appropriate?**
     - Lean, agile or leagile
  2. **Explain why** you have reached this answer
  3. **Identify examples** of supply chains that fit this categorisation

- Also complete the acetate version of the diagram

- Each group to present their ideas
  (5 minutes each group)
Marks and Spencer
Case I
Marks and Spencer – 1990s

- Until the 1990s, sourced products from the UK
- In the 1990s, began to source from overseas
  - Required established suppliers to go overseas
  - Open sourcing policies

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<thead>
<tr>
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<th>Average hourly labour cost</th>
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<tr>
<td>UK</td>
<td>$9.50</td>
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<tr>
<td>Morocco</td>
<td>$1.20</td>
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<tr>
<td>China, Pakistan, Indonesia</td>
<td>$0.50</td>
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Christopher et al. (2006)
Marks and Spencer – 1990s

- **Problems that emerged**
  - Did not secure *transport capacity or import quotas* ahead of season
  - **Lead times** of months for orders

- **There was negative impact on profitability in late 1990s**
  - Too *narrow definition of cost*
  - “One size fits all” approach to supply chain
  - Buyers sourcing the *wrong style* of clothes
“Lack of flexibility has been a major weakness within our supply chain. In the past, we bought stock to cover 100% of budgeted sales well in advance of the season. We have now discontinued this practice. For Spring 2001, while 50% of merchandise is core and therefore bought with long lead-times, we will commit to approximately 40% of merchandise much closer to the season, and a further 10% will be bought in the season itself in response to emerging fashion trends.”

M&S Interim Report 2002
Marks and Spencers – 2000s

- **Sourcing decisions now include**
  - Predictability of demand
  - Length of season
  - Journey time

- By Spring 2004, **80%** of clothing manufactured **overseas**
  - Cambodia and other up and coming Asian countries
  - Eastern Europe

- **Top 15 suppliers** account for **92%** of clothing business

Christopher et al. (2006)
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Christopher et al. (2006)
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*Christopher et al. (2006)*
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- **Predictable**
  - Lean
    - Continuous Replenishment
  - Agile
    - Quick Response

- **Unpredictable**
  - Lean
    - Plan and execute
  - Leagile
    - Postponement

*Christopher et al. (2006)*
Agile or lean?

- **AGILE**
  - High variety/variability
  - High volume per variant
  - ‘Lean’ works best in high volume, low variety and predictable environments

- **LEAN**
  - Low variety/variability
  - High volume per variant
  - ‘Agility’ is needed in less predictable environments where the demand for variety is high
Generic SC Strategies

- Latest version of Christopher (2012)
- What’s different?
- Kanban?
- Hybrid?
Lean? Agile?

Driven by demand

Driven by forecast

Plants → Distribution centres → Warehouses → Depots

Christopher (2011)
Decoupling Point

Christopher (2011)
The de-coupling point

Lean

- Forecast at generic level
- Economic batch quantities
- Maximise efficiencies

Strategic inventory

Agile

- Demand driven
- Localised configuration
- Maximise effectiveness

Christopher (2011)
Figure 5.14 Routemap to the responsive business

- Standardisation/modularisation
- Economies of scale
  - Capacity management
  - Flexible response
    - Set-up time reduction
    - Non-value-adding time reduction
  - Quick response
    - Process re-engineering
- Lean production
  - De-couple the supply chain
  - Quick response
- Waste reduction
  - Vendor managed inventory
- Synchronised production
- Agile supply
  - Demand driven
  - Visibility of real demand
  - Continuous replenishment programmes
- Organisational agility
  - Cross-functional teams
  - Process management

Christopher (2011)
Push vs Pull in the logistics chain

- Demand pull
- Kanban
- Product Push
- Forecast

Christopher (2011)
Reducing set-up/ordering cost
Reducing the EOQ batch
Griffin Manufacturing
Case II
Griffin Manufacturing

- Manufacturer of **apparel** in the **United States**
- Specialises in **athleticware**
- **Strong competition from overseas** competitors
- Major customer wanted to transfer manufacturing to Honduras

“Every time Griffin makes a garment, it costs us $1”

- About 20% of manufacturing remains in the US

Warburton and Stratton (2002)
# US/Honduras Cost Comparison

## Product: Jogging bra

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Honduras</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour cost (6 minutes sewing)</td>
<td>$0.75</td>
<td>$0.03</td>
<td>-$0.72</td>
</tr>
<tr>
<td>Transport</td>
<td>$0.00</td>
<td>$0.01</td>
<td>-$0.01</td>
</tr>
<tr>
<td>Other costs</td>
<td>$0.75</td>
<td>$0.46</td>
<td>-$0.29</td>
</tr>
<tr>
<td>Total costs/bra</td>
<td>$1.50</td>
<td>$0.50</td>
<td>-$1.00</td>
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## Hidden costs

- Lower operator efficiency
- High staff turnover
- Manage exports/imports
- Travel costs

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Warburton and Stratton (2002)
Other issues

- **Fluctuating demand**
  - Emergency orders needed on short lead times
  - Extra cost of having quick response capacity available offsets the value of the order

- **Forecast errors**
  - 25% error common for fashion items
  - Results in either too much stock or unhappy customers

Warburton and Stratton (2002)
Griffin’s New Approach
Pipeline Types

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Christopher et al. (2006)
Conclusions

- Global supply chains need to be effectively designed
- This can exploit the lean/agile principles discussed previously
- A key element is lead time as this affects the responsiveness of the supply chain
  - Lean – long lead time
  - Agile – short lead time
From Mass Production to Mass Customisation

The Revision
Lecture Outline

- Historical background (**craft – mass production – mass customisation**)
- Mass customisation – some examples
- Important concepts:
  - Decoupling point
  - Modularity
  - Postponement
- Conclusion
Craft Production

Everything was crafted by the hands of someone who had the requisite materials, tools, and most important skills.

Every product was unique (highly customised)

Long lead time and very limited distribution
Mass Production

Popularised after the assembly lines for making Ford Model T in 1913. The amount of labour time spent making a single car dropped from 12 hours to 2.5 hours.

Main characteristics:
- Interchangeable parts
- Specialised machines
- Focus on the process of production
- Division of labour
- Focus on low costs and low prices
- Economies of scale
- Product standardisation
Limits to Mass Production

- **Labour costs** cannot be kept coming down relative to the price of a product
- The homogeneity of markets is threatened by the changing needs and wants of customers
- Unstable demand affected by technological shocks
Mass Customisation

“The cost-efficient production of goods and or services tailored towards an individual customer’s needs“ (Pine, 1993)
Craft vs Mass Production

- Craft
  - Highly customised
  - Slow delivery
  - High cost

- Mass production
  - Very standardised
  - Fast delivery
  - Low cost
Mass Customisation

- Slow delivery
  - High cost
- Fast delivery
  - Low cost

Highly customised

very Standardised

Craft

Mass production
Mass Customisation

- Highly customised
- Mass production

- Craft
- Slow delivery
  - High cost
- Fast delivery
  - Low cost

- Very standardised
Mass Customisation

Craft

Highly customised

Mass customisation

Mass production

very Standardised

Slow delivery High cost

Fast delivery Low cost
Mass Customisation

- Mass Customisation
- Slow delivery, High cost
- Mass production
- Fast delivery, Low cost

Highly customised vs. Standardised

Craft 

Mass customisation
## Mass Production vs. Mass Customisation

<table>
<thead>
<tr>
<th></th>
<th>Mass Production</th>
<th>Mass Customisation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Focus</strong></td>
<td>Efficiency through stability</td>
<td>Variety and customisation through flexibility and responsiveness</td>
</tr>
<tr>
<td><strong>Goal</strong></td>
<td>Developing, producing, and marketing goods and services at prices low enough that nearly everyone can afford them</td>
<td>Developing, producing, and marketing affordable goods and services with enough variety and customisation</td>
</tr>
<tr>
<td><strong>Key Features</strong></td>
<td>- Stable demand</td>
<td>- Fragmented demand</td>
</tr>
<tr>
<td></td>
<td>- Large homogenous markets</td>
<td>- Heterogeneous markets</td>
</tr>
<tr>
<td></td>
<td>- Low-cost, consistent quality, standardised goods</td>
<td>- Low-cost, high-quality, customised goods</td>
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<tr>
<td></td>
<td>- Long product development cycles</td>
<td>- Short product development cycles</td>
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<td>- Long product life cycles</td>
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(Source: Pine, 1993)
## Product – Process Matrix

<table>
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<tr>
<th>Process</th>
<th>Low volume, custom products</th>
<th>Low-medium volume, many products</th>
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Adapted from Hayes and Wheelwright (1979)
## Where is Mass Customisation? & Why so?

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Adapted from Hayes and Wheelwright (1979)
Mass Customisation
Dell recommends Windows® XP Professional

XPS 600 Product Details

Customize Your Ideal System

Embrace the power of two - dual-core processing and dual graphics put the XPS 600 in elite company. Packed with some of the latest in high performance technology, including the...
Mass Production

Designer's Concept | Fit Model | Mass Production | Shipping to Store | Try-on in Store | Misfit

Mass Customisation

Your Concept | Body Scan | Style Choices | Flexible Production | Home Delivery | Perfect Fit

Source: http://www.explore.cornell.edu
Cycle View of Supply Chains

Customer Order Cycle

Replenishment Cycle

Manufacturing Cycle

Procurement Cycle

Customer

Retailer

Distributor

Manufacturer

Supplier

Chopra and Meindl
Push/Pull View of Supply Chains

Procurement, Manufacturing and Replenishment cycles

Customer Order Cycle

PUSH PROCESSES

PULL PROCESSES

Decoupling Point
Decoupling point

“The point in the goods flow where forecast driven activities and customer order driven activities are separated “

(Giesberts and van der Tang, 1992)
Decoupling point

Naylor et al. (1999)
## Categorising Products

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<th>Functional Products</th>
<th>Innovative Products</th>
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Decoupling point

Demand upstream from the decoupling point

Demand downstream from the decoupling point

LEAN

AGILE
Modularity (Component Commonality)

“Economies of scope are gained by using the modular components over and over in different products; and customisation is gained by the myriad of products that can be configured”

(Pine, 1993)
Modularity (Component Commonality)

No component commonality

Step 1  Storage 1  Step 2  Storage 2

With component commonality
Postponement

“Postponement is done by properly designing the product structure and the manufacturing and supply chain process so that one can delay the point in which the final customisation of the product is to be configured“

(Swaminathan and Lee, 1993)
Postponement

Example: Dell, Benetton, New concept of paint
Postponement Evaluation

Benefits:
• Increased sales
• Lower inventory holding cost
• Lower obsolescence cost

Costs:
• Direct cost increases caused by product or process redesign
• Indirect cost increases
Optimal Preconditions for Postponement

- **Demand**
  - Fluctuation
  - Unpredictability
  - Differentiation
  - Negative correlation

- **Product**
  - High product value
  - High customisation
Optimal Preconditions for Postponement

- Production
  - Balanced capabilities
  - Availability and quality of the suppliers
  - Availability of IT systems
Conclusions

- The **customer centric** perspective is the main driver of the shift from mass production to mass customisation.

- **Decoupling point or push/pull boundary** is an important concept in mass customisation. It is used as the basis of where to apply **lean** or **agile** strategy in a supply chain.

- **Modularity** and **postponement** are inter-related and both represent key enablers to enhance **flexibility** in mass customisation.
Refreshment Break
Global Supply Network Design

International Logistics and Supply Chain Management

Week 2 | Day 2
Lecture Outline

- Drivers of supply chain performance
- Distribution network in the supply chain
- Some key trade-offs
- Design options for a distribution network
- Conclusion
Supply chain strategy

Source: Chopra and Meindl
Drivers of Supply Chain Performance

- **Facilities**
  - production sites and storage sites

- **Inventory**
  - raw materials, WIP, finished goods within a supply chain

- **Transportation**
  - moving inventory from point to point in a supply chain

- **Information (Week 3 – Supply Chain Collaboration)**
  - data and analysis regarding inventory, transportation, facilities throughout the supply chain

- **Sourcing (Outsourcing)**
  - functions a firm performs and functions that are outsourced

- **Pricing (Pricing and revenue management)**
  - Price associated with goods and services provided by a firm to the supply chain
Drivers of Supply Chain Performance

- Facilities
  - Role in the supply chain: *what; how; where*
  - Role in the competitive strategy: responsiveness – efficiency
  - Components of facilities decisions:
    - Role
    - Location
    - Capacity
Drivers of Supply Chain Performance

- **Inventory**
  - Role in the supply chain: *what; how; where*
  - Role in the competitive strategy: responsiveness – efficiency
  - Components of inventory decisions:
    - Cycle inventory
    - Safety inventory
    - Seasonal inventory
    - Level of product availability
Drivers of Supply Chain Performance

- Transportation
  - Role in the supply chain: *what; how; where*
  - Role in the competitive strategy: responsiveness – efficiency
  - Components of inventory decisions:
    - Design of transportation network
    - Choice of transportation mode
The Role of Distribution in the Supply Chain

- *Distribution*: the steps taken to move and store a product from the supplier stage to the customer stage in a supply chain

- Distribution directly affects cost and the customer experience and therefore drives profitability

- The choice of distribution network is related to the choice between *efficiency* and *responsiveness*
Factors Influencing Distribution Network Design

- Distribution network performance is evaluated based on:
  - Customer service
  - Supply chain cost
Factors Influencing Distribution Network Design

• **Elements of customer service**
  – Response time
  – Product variety
  – Product availability
  – Customer experience
  – Order visibility
  – Returnability
Factors Influencing Distribution Network Design

• Elements of supply chain cost:
  – Inventory
  – Transportation
  – Facilities
  – Information
Service and Number of Facilities

Number of Facilities vs. Response Time
Example: Nestle UK
Example: Nestle UK

Delivery lead time requested by retailers = 48 hours
Example:

- 3 DCs (2000-Milton Keynes; 2004-Gourock; 2005-Glenrothes)
- Next (4th): Swansea
Inventory Costs and Number of Facilities

Inventory Costs

Number of facilities
Transportation Costs and Number of Facilities
Facility Costs and Number of Facilities
Total Costs Related to Number of Facilities

- Total Costs
- Facilities
- Inventory
- Transportation

Number of Facilities vs. Total Costs
Total Logistics Costs and Response Time with Number of Facilities

Number of Facilities

Response Time

Total Logistics
Impact of e-business on customer service

- Response time to customers
- Product variety
- Product availability
- Customer experience
- Faster time to market
- Order visibility
- Returnability
- Flexible pricing
- Efficient funds transfer
Impact of e-business on cost

- Inventory
  - Lower inventory level

- Facilities
  - Costs related to the number and location of facilities
  - Costs associated with the operations

- Transportation
  - Tend to have higher transportation (outbound) cost
Manufacturer Storage with Direct Shipping

Source: Chopra and Meindl
**Lyte Aluminium Platform Steps (Class 1) (DD)**
Certified to BS2037 class 1; these steps are very robust. All treads are non-slip, and double riveted.

**From £76.95 inc. VAT**

**Lyte Aluminium Swing Back Steps (Class 1) (DD)**
Certified to BSEN131 and BS2037 class 1; these steps are very robust. A unique strengthening beam in.

**From £55.95 inc. VAT**

**Lyte Double Extension Trade Ladder (DD)**
Certified to BSEN131; these ladders are ideal for all types of trade work. They have comfortable D...

**More Info**
In-Transit Merge Network

Example: Dell

Source: Chopra and Meindl
Distribution hub (In-transit merge)

(Walsh Western International)
Distributor Storage with Carrier Delivery

Factories

Warehouse Storage by Distributor/Retailer

Customers

Example: Amazon

Source: Chopra and Meindl
Distributor Storage with Last Mile Delivery

Factories

Distributor/Retailer Warehouse

Customers

Product Flow

Information Flow
Manufacturer or Distributor Storage with Customer Pickup

Factories

Cross Dock DC

Retailer

Pickup Sites

Customers

Source: Chopra and Meindl
### Comparative Performance of Delivery Network Designs

<table>
<thead>
<tr>
<th></th>
<th>Retail Storage with Customer Pickup</th>
<th>Manufacturer Storage with Direct Shipping</th>
<th>Manufacturer Storage with In-Transit Merge</th>
<th>Distributor Storage with Package Carrier Delivery</th>
<th>Distributor storage with last mile delivery</th>
<th>Manufacturer storage with pickup</th>
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</thead>
<tbody>
<tr>
<td><strong>Response Time</strong></td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
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<tr>
<td><strong>Product Variety</strong></td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Product Availability</strong></td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Customer Experience</strong></td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td><strong>Order Visibility</strong></td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>6</td>
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<tr>
<td><strong>Returnability</strong></td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>Inventory</strong></td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td><strong>Facility &amp; Handling</strong></td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Chopra and Meindl

1-strongest
6-weakest
Conclusion

- Facilities, inventory, transportation are the main logistical drivers that should be considered in the supply chain network design.
- Customer service and supply chain cost are two important measures when evaluating a distribution network.
- E-business has a significant impact on supply chain network decisions.
Outsourcing in Supply Chain Management
Lecture Outline

- Context for outsourcing
- Outsourcing continuum
- Benefits and costs
- Outsourcing in airline MRO supply chains
- Conclusions
Make or Buy?

- One of the most fundamental strategic questions any organisation needs to address is to determine whether an activity should be:

1. Completed by an in-house team or
2. Procured from an outside party

It has to ask the “make or buy” question

or

Define what the organisational boundaries are
Organisational Structure

- Is the organisation best able to perform when:
  - It is large and is responsible for a wide range of activities up and down its interested value streams and potentially complimentary activities
  - Or
  - It is smaller and more fragmented specialising in certain activities only and transacting with suppliers and customers relevant to the business?
Make or Buy?

“Whenver a company produces something internally that others can buy or produce more efficiently and effectively, it sacrifices competitive advantage”

Quinn, J., Doorley, T. and Paquette, P. (1990)

Domberger (1998)
Is Being Big Best?

• After World War II the “mega corporation” became the model of success
  • Security in size

• But on average profitability was lower in large firms if less variable
  • “The trade off was lower risk for lower return!”

• From the 1980’s onwards however, the competitive climate has been much harsher

Domberger (1998)
Is Being Big Best?

- A range of external forces has meant there is now less room for inefficiencies – e.g.
  - **Globalisation**
  - Advances in **ICT**
  - The Changing **Customer**

- This has led to a greater emphasis on **specialisation**

Domberger (1998)
Motivations for In/ Outsourcing

- New product development
- Strategy development
- Poor internal or external performance
- Changing demand patterns
- Shifting technology life cycles

Handfield and Nichols (2002)
## Benefits of Contracting

<table>
<thead>
<tr>
<th>Title</th>
<th>Definition</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specialisation</strong></td>
<td>Concentration on activities which organisation has a <strong>distinctive capability</strong></td>
<td>Concentrating on an organisation’s more <strong>efficient activities</strong> leads to economic benefits</td>
</tr>
<tr>
<td><strong>Market Discipline</strong></td>
<td>Identifying conditions where <strong>purchase is separated</strong> from provider</td>
<td><strong>Purchaser focus on outputs and supplier contestability</strong></td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>Ability to <strong>adjust scale and scope</strong> of production up or down at low cost and rapid rate</td>
<td><strong>Networks of small organisations can change more quickly and at lower cost</strong></td>
</tr>
<tr>
<td><strong>Cost Savings</strong></td>
<td>Lower resource <strong>costs of service v in-house rate</strong></td>
<td><strong>Int. studies – savings in the order of 20%.</strong></td>
</tr>
</tbody>
</table>

Domberger (1998)
Costs of Contracting (1)

- Hollowing Out
- Loss of Skills
- Loss of Corporate Memory
- Weakened Innovative Capacity
- Transaction (switching) Costs

Domberger (1998)
Costs of Contracting (2)

- Monitoring Costs
- Loss of Control
- Coordination Problems
- Lack of Investment (in purchased activities)
- Breakdown of Trust and Cooperation

Domberger (1998)
Benefits v Costs

- The question is **not whether benefits exceed costs**

- Rather – **how** can a **contract** be drawn up so that the **benefits outweigh the costs**
  
  “How to combine **flexibility with control**”

- For many activities it seems that this position can be reached – including the provision of logistics

Domberger (1998)
Airline Maintenance

- **Maintenance is critical** to the airline industry
- For a UK based regional airline, technical problems accounted for 22% of delays in terms of frequency and 39% in terms of time

- There are a number of areas for aircraft maintenance
  - **Line maintenance** – day-to-day repairs
  - **Base maintenance** – major aircraft examinations
  - **Engine maintenance** – often the most expensive part
  - **Spares and rotables** – support aircraft maintenance
  - **Aircraft modifications** – updating systems
Outsourcing Approaches

Activities under airline control

- Maintenance
- Inventory
- Line Maintenance
- Base Maintenance

Serviceable aircraft
Decision Framework

  - N → Buy
  - Y → Make and Buy

- Make
- Make and Sell
## Pilot Study

<table>
<thead>
<tr>
<th>MRO Activity</th>
<th>In-sourced</th>
<th>Some outsourcing</th>
<th>Fully outsourced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line</td>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Engine</td>
<td></td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Spares</td>
<td></td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Modifications</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
International Survey

- This had 3 objectives
  - What **MRO activities** are outsourced?
  - What **factors affect the MRO outsourcing decision**?
  - How does outsourcing affect **cost and reliability**?

- Survey sent globally but best response from Europe
  - 181 surveys sent, **22 returned (12%** response rate)

- Responses grouped as low and high outsourcing
## Factors Affecting Outsourcing

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet Size</td>
<td>High Outsourcing</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>Low Outsourcing</td>
<td>35.5</td>
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<tr>
<td>Fleet Mix</td>
<td>High Outsourcing</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>Low Outsourcing</td>
<td>2.9</td>
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<tr>
<td>Fleet Utilisation</td>
<td>High Outsourcing</td>
<td>10.0</td>
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<tr>
<td></td>
<td>Low Outsourcing</td>
<td>7.86</td>
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<tr>
<td>Fleet Age</td>
<td>High Outsourcing</td>
<td>8.38</td>
</tr>
<tr>
<td></td>
<td>Low Outsourcing</td>
<td>10.37</td>
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<tr>
<td>% of leased aircraft</td>
<td>High Outsourcing</td>
<td>81.6</td>
</tr>
<tr>
<td></td>
<td>Low Outsourcing</td>
<td>49.77</td>
</tr>
</tbody>
</table>
Factors Affecting Outsourcing

- The survey also looked at ownership and business strategy

  - **Ownership**
    - Split airlines into private, government and mixed
    - Insufficient data to draw meaningful conclusions

  - **Strategy**
    - Scheduled, non-scheduled and low cost
    - Scheduled tended to have low levels of outsourcing
    - Low cost airlines tended to have high levels of outsourcing
## Impact of Outsourcing

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRO Cost as % of operations cost</td>
<td>High Outsourcing</td>
<td>25.54</td>
</tr>
<tr>
<td></td>
<td>Low Outsourcing</td>
<td>2.58</td>
</tr>
<tr>
<td>Technical punctuality</td>
<td>High Outsourcing</td>
<td>5.09</td>
</tr>
<tr>
<td></td>
<td>Low Outsourcing</td>
<td>23.77</td>
</tr>
</tbody>
</table>
Summary of Airline MRO Outsourcing

Inputs
- Fleet size
- Fleet Mix
- Airline Business Model

MRO Activities
- In-sourced
- Outsourced

Outputs
- MRO Cost
- Technical Delays

LM = Line Maintenance, BM = Base Maintenance, EM = Engine Maintenance, S&R = Spares and Rotables, AM = Aircraft Modifications
Conclusions

- Outsourcing is increasingly taking an important role within supply chain management
- It affects the structure of the supply chain and the nature of logistics operations
- Through outsourcing, the company can specialise in particular areas
- However, there are also risks associated with the use of third parties
Lecture Outline

- Context for outsourcing
- Outsourcing continuum
- Benefits and costs
- Outsourcing in airline MRO supply chains
- Conclusions
Thank You

See You Next Week