

Chapter 6.

Designing Global Supply Chain Networks

2021

Manhattan, Kansas

Learning Objectives

- Identify factors that need to be *included in total cost* when making global sourcing decisions.
- Define *relevant risks and different strategies* that may be used to mitigate risk in global supply chains.



Impact of Globalization on Supply Chain Networks



Impact of Globalization on Supply Chain Networks

- Opportunities to simultaneously *grow* revenues and *decrease* costs
- Accompanied by significant *additional risk*
- Difference between success and failure often ability to incorporate suitable risk mitigation into supply chain design
- Uncertainty of demand and price drives the value of building flexible production capacity

Impact of Globalization on Supply Chain Networks

TABLE 6-1 Results of Accenture Survey on Sources of Risk That Affect Global Supply Chain Performance

| Risk Factors | Percentage of Supply Chains Affected |
|--|--------------------------------------|
| Natural disasters | 35 |
| Shortage of skilled resources | 24 |
| Geopolitical uncertainty | 20 |
| Terrorist infiltration of cargo | 13 |
| Volatility of fuel prices | 37 |
| Currency fluctuation | 29 |
| Port operations/custom delays | 23 |
| Customer/consumer preference shifts | 23 |
| Performance of supply chain partners | 38 |
| Logistics capacity/complexity | 33 |
| Forecasting/planning accuracy | 30 |
| Supplier planning/communication issues | 27 |
| Inflexible supply chain technology | 21 |

Source: Adapted from Jaume Ferre, Johann Karlberg, and Jamie Hintlian, “Integration: The Key to Global Success.” *Supply Chain Management Review* (March 2007): 24–30.



The Importance of Total Cost in Global Networks

The Importance of Total Cost in Global Networks

- Comparative advantage in global supply chains
- Quantify the benefits of offshore production along with the reasons
- Two reasons for offshoring failure:
 - Focusing exclusively on unit cost rather than total cost
 - Ignoring critical risk factors

Dimensions to Consider When Evaluating Total Cost From Offshoring

| Performance Dimension | Activity Affecting Performance | Impact of Offshoring |
|-------------------------|--|---|
| Order communication | Order placement | More difficult communication |
| Supply chain visibility | Scheduling and expediting | Poorer visibility |
| Raw material costs | Sourcing of raw material | Could go either way depending on raw material sourcing |
| Unit cost | Production, quality (production and transportation) | Labor/fixed costs decrease; quality may suffer |
| Freight costs | Transportation modes and quantity | Higher freight costs |
| Taxes and tariffs | Border crossing | Could go either way |
| Supply lead time | Order communication, supplier production scheduling, production time, customs, transportation, receiving | Lead time increase results in poorer forecasts and higher inventories |

Dimensions to Consider When Evaluating Total Cost From Offshoring

| | | |
|--|--|--|
| On-time delivery/lead time uncertainty | Production, quality, customs, transportation, receiving | Poorer on-time delivery and increased uncertainty resulting in higher inventory and lower product availability |
| Minimum order quantity | Production, transportation | Larger minimum quantities increase inventory |
| Product returns | Quality | Increased returns likely |
| Inventories | Lead times, inventory in transit and production | Increase |
| Working capital | Inventories and financial reconciliation | Increase |
| Hidden costs | Order communication, invoicing errors, managing exchange rate risk | Higher hidden costs |
| Stockouts | Ordering, production, transportation with poorer visibility | Increase |

The Importance of Total Cost in Global Networks

Key elements of total cost

- Supplier price
- Terms
- Delivery costs
- Inventory and warehousing
- Cost of quality
- Customer duties, value added-taxes, local tax incentives
- Cost of risk, procurement staff, broker fees, infrastructure, and tooling and mold costs
- Exchange rate trends and their impact on cost

The Importance of Total Cost in Global Networks

- A global supply chain with offshoring increases the length and duration of information, product, and cash flows
- The complexity and cost of managing the supply chain can be significantly higher than anticipated
- Quantify factors and track them over time
- Big challenges with offshoring is increased risk and its potential impact on cost



Risk Management in Global Supply Chains

Risk Management in Global Supply Chains

| Category | Risk Drivers |
|---------------|---|
| Disruptions | Natural disaster, war, terrorism |
| | Labor disputes |
| | Supplier bankruptcy |
| Delays | High capacity utilization at supply source |
| | Inflexibility of supply source |
| | Poor quality or yield at supply source |
| Systems risk | Information infrastructure breakdown |
| | System integration or extent of systems being networked |
| Forecast risk | Inaccurate forecasts due to long lead times, seasonality, product variety, short life cycles, small customer base |

Risk Management in Global Supply Chains

| | |
|----------------------------|---|
| Intellectual property risk | Vertical integration of supply chain |
| | Global outsourcing and markets |
| Procurement risk | Exchange rate risk |
| | Price of inputs |
| | Fraction purchased from a single source |
| | Industrywide capacity utilization |
| Receivables risk | Number of customers |
| | Financial strength of customers |
| Inventory risk | Rate of product obsolescence |
| | Inventory holding cost |
| | Product value |
| | Demand and supply uncertainty |
| Capacity risk | Cost of capacity |
| | Capacity flexibility |

Risk Management in Global Supply Chains

- Good network design can play a significant role in mitigating supply chain risk
- Every mitigation strategy comes at a price and may increase other risks
- Global supply chains should generally use a combination of rigorously evaluated mitigation strategies along with financial strategies to hedge uncovered risks



Risk Mitigation Strategies

Risk Management in Global Supply Chains

| Risk Mitigation Strategy | Tailored Strategies |
|----------------------------|--|
| Increase capacity | Focus on low-cost, decentralized capacity for predictable demand. Build centralized capacity for unpredictable demand. Increase decentralization as cost of capacity drops. |
| Get redundant suppliers | More redundant supply for high-volume products, less redundancy for low-volume products. Centralize redundancy for low-volume products in a few flexible suppliers. |
| Increase responsiveness | Favor cost over responsiveness for commodity products. Favor responsiveness over cost for short-life cycle products. |
| Increase inventory | Decentralize inventory of predictable, lower-value products. Centralize inventory of less predictable, higher-value products. |
| Increase flexibility | Favor cost over flexibility for predictable, high-volume products. Favor flexibility for unpredictable, low-volume products. Centralize flexibility in a few locations if it is expensive. |
| Pool or aggregate demand | Increase aggregation as unpredictability grows. |
| Increase source capability | Prefer capability over cost for high-value, high-risk products. Favor cost over capability for low-value commodity products. Centralize high capability in flexible source if possible. |



Flexibility, Chaining, and Containment

Flexibility, Chaining, and Containment

Three broad categories of flexibility

New product flexibility

- Ability to introduce new products into the market at a rapid rate

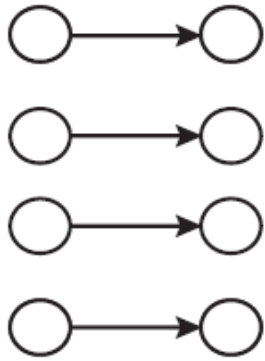
Mix flexibility

- Ability to produce a variety of products within a short period of time

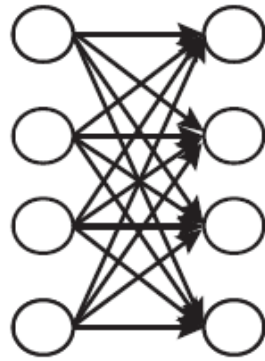
Volume flexibility

- Ability to operate profitably at different levels of output

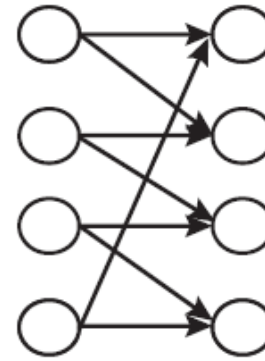
Flexibility, Chaining, and Containment



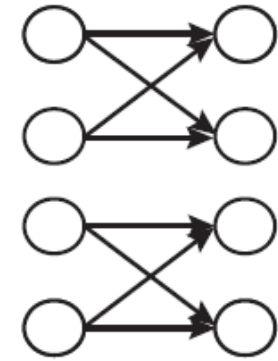
Dedicated
Network



Fully Flexible
Network



Chained Network
with One Long
Chain



Chained Network
with Two Short
Chains

FIGURE 6-1 Different Flexibility Configurations in Network



Discounted Cash Flow Analysis

Discounted Cash Flow Analysis

- Supply chain decisions should be evaluated as a sequence of cash flows over time
- Discounted cash flow (DCF) analysis evaluates the present value of any stream of future cash flows and allows managers to compare different cash flow streams in terms of their financial value
- Based on the time value of money – a dollar today is worth more than a dollar tomorrow

Discounted Cash Flow Analysis

$$\text{Discount factor} = \frac{1}{1+k}$$

$$\text{NPV} = C_0 + \sum_{t=1}^T \left(\frac{1}{1+k} \right)^t C_t$$

where

C_0, C_1, \dots, C_T is stream of cash flows over T periods

NPV = net present value of this stream

k = rate of return

- Compare NPV of different supply chain design options
- The option with the highest NPV will provide the greatest financial return

Discounted Cash Flow Analysis

<https://www.youtube.com/watch?v=HRwK3cbkywk>



Using Decision Trees

Using Decision Trees

A **decision tree** is a graphic device used to evaluate decisions under uncertainty

- Identify the number and duration of time periods that will be considered
- Identify factors that will affect the value of the decision and are likely to fluctuate over the time periods

Using Decision Trees- Decision Tree Methodology

1. Identify the duration of each period (month, quarter, etc.) and the number of periods T over which the decision is to be evaluated
2. Identify factors whose fluctuation will be considered (e.g demand, price, and exchange rates) over the next T periods
3. Identify representations of uncertainty for each factor (that is, determine what distribution to use to model the uncertainty)

Using Decision Trees- Decision Tree Methodology

4. Identify the periodic discount rate k for each period
5. Represent the decision tree with defined states in each period as well as the transition probabilities between states in successive periods
6. Starting at period T , work back to Period 0, identifying the optimal decision and the expected cash flows at each step

Using Decision Trees

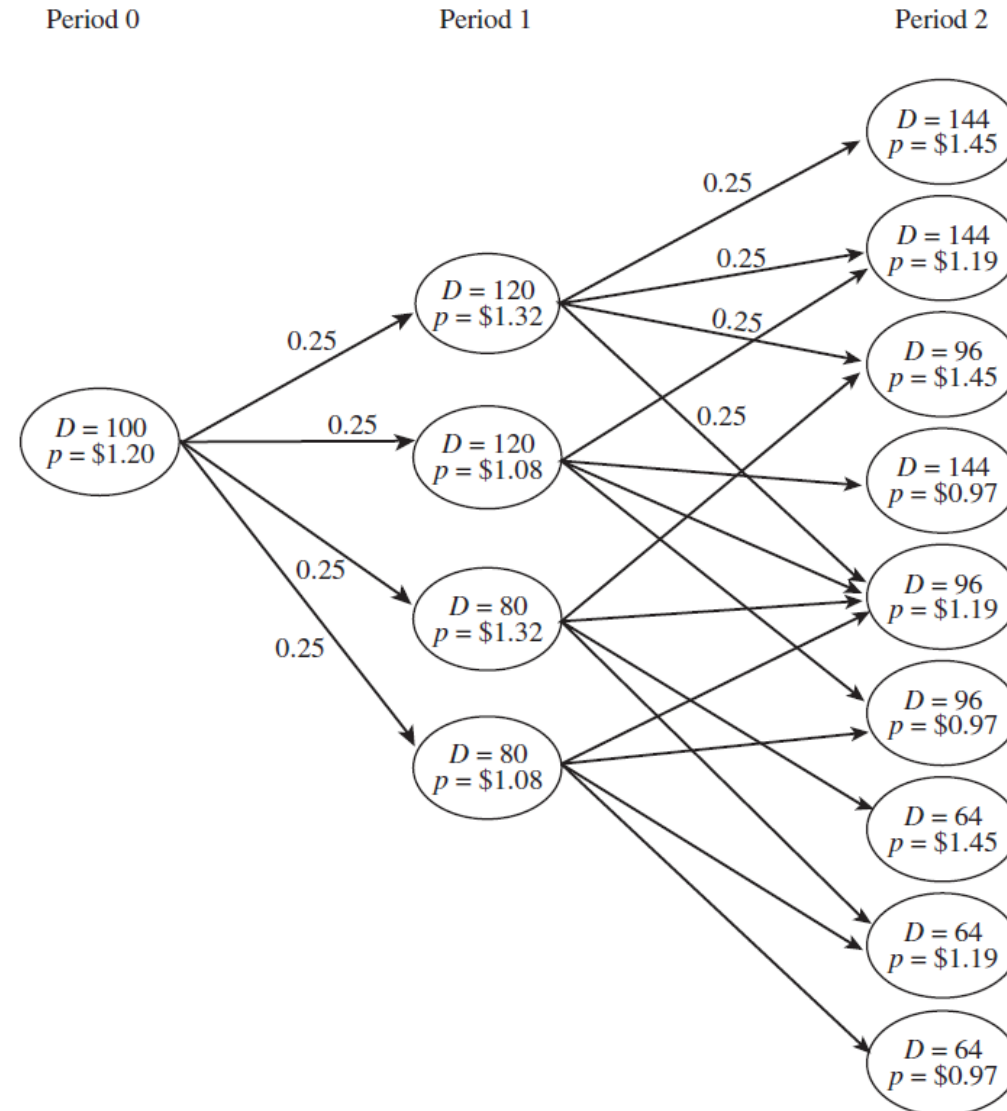


FIGURE 6-2 Decision Tree for Trips Logistics, Considering Demand and Price Fluctuation



AGEC 632: Agribusiness Logistics

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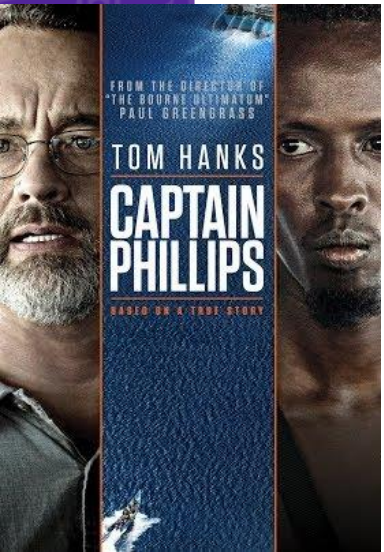
Reading #4 (4 links)

Melting Arctic ice opens new route from Europe to east Asia

<https://www.theguardian.com/world/2018/sep/28/melting-arctic-ice-opens-new-route-from-europe-to-east-asia>

The final frontier: how Arctic ice melting is opening up trade opportunities

<https://www.weforum.org/agenda/2020/02/ice-melting-arctic-transport-route-industry/>



Pirates are kidnapping more seafarers off West Africa, IMB reports

<https://iccwbo.org/media-wall/news-speeches/imb-piracy-report-2020/>

Piracy in West Africa: The world's most dangerous seas?

<https://www.bbc.com/news/world-africa-48581197>