Summary Concepts: Facilities Strategy and Globalization

Lecture 12
Summary lecture on facilities strategy and globalization

- Conclusions from ITT, Applichem, etc.
- Strategic and other factors
- An integrated approach
- Impacts of globalization
- New paradigms for the global environment
Issues from BYD and Applichem

• Fit with strategy
• Focus of plants
• Scale and cost
• Standardization and labor costs
• Means of evaluation and plant roles
• Sourcing and allocation models
• Access to R&D
**Product/Market-Process Focus**

- **Mean of focus**
  - Volume
  - Product
  - Market
  - Process

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Scale Analysis

The graph illustrates the cost and volume for two different technologies. Technology 1 and Technology 2 show different cost-volume relationships. The Subcontract line indicates an alternative cost structure that depends on the volume of production.
Consumer Goods Example

Cost per unit

Volume in millions of units

[Graph showing the relationship between volume in millions of units and cost per unit.]
Additional logistics drivers

- Raw material access (e.g. wood products)
- Distributed production for heavy products
- Warehouses for commodities because of transportation scale
- Customer service requirements
Supply Chain Flow: Simple Two-Stage LP
Network for Multi-Location Supply Chain

Suppliers  →  Plants  →  Distribution Centers  →  Customers
General Manufacturing Models (shared capacity, warehouses or two stages, fixed costs – details in extra slide)

\[ X_{lkj} = \text{Total flow of } l \text{ from } k \text{ to customer } j \]

\[ Y_{ikl} = \text{Total flow of type } l \text{ from } i \text{ to } k \]

\[ D_{lj} = \text{Demand of } l \text{ at customer } j \]

\[ D_j = \sum D_{lj} \]

\[ A_k = \text{Capacity at warehouse } k \]

\[ A_{il} = \text{Capacity at plant } i \text{ for product } l \]
Some Examples of Strategies

1. Different process steps and scale, significant logistics
   - Central stage 1, decentralized stage 2

2. Significant central R&D
   - Central plant for at least early life cycle

3. Significant product flexibility
   - Decentralized satellite plants for some stages
A General Approach

• Develop a strategy and appropriate means of focus
• Using data, benchmarking, and analysis of technology, develop scale curves
• Identify major decision choices and service requirements covering plant and process options
• Do the analysis
Case Study: *Worldwide Consumer Goods Manufacturer*

- 25 product groups
- 10 production locations
- Variety of product values and weights
- Over capacity
- Lack of focus
- Significant tax issues
# Case Study

## Why Separate?
- Scale
- Capacity
- Tax laws
- Focus
- Relative technological complexity

## Approach
- Cross sectional analysis
- Tax analysis
- Model of variable costs
- Detailed analysis of actual fixed costs

## Solution:
- Move “light” products to tax havens
- Better focus facilities by product group
Globalization Adds Some Additional Complexities

- **Increase in worldwide exports**
- **Business level trends**
  - New technologies such as lower-scale, higher-skill level manufacturing systems including FMS systems
  - JIT systems that also underscore the need for sophisticated vendor infrastructure
  - TQM and organizational learning
  - Competitive factors that focus on customization, rapid product development, and quick response
  - The breakdown of intercompany barriers
Globalization Complexities (cont’d)

- **Macro level trends**
  - Large, sophisticated overseas markets with local needs
  - Non-tariff barriers
  - Regionalized trading economies
- **Variable factor costs – Static and Dynamic differences**
- **Longer lead times**
Global Strategies Emphasize Some Additional Factors

- Global product volumes and life cycles
- Decentralized network based on regional presence
- Infrastructure versus cost
  - Work force capabilities
  - Vendors
  - Transportation and communication
- Extra plants and capacity to build flexibility for exchange rate risks
- Flexibility in short, medium, and long term
Exchange Rate Model

![Graph showing exchange rate model with cost and total capacity axes.](image)

- **Cost** range from 400 to 460.
- **Total Capacity** range from 0 to 400.
- Different lines represent the cost of different numbers of plants:
  - **One** (black line).
  - **Two** (pink line).
  - **Three** (yellow line).
  - **Four** (cyan line).
  - **Five** (purple line).

Legend:
- One
- Two
- Three
- Four
- Five
Facilities Strategy Given Uncertainty
(adapted from Huchzermeir and Cohen)

Alternative Facilities Configurations

Switching Costs

Alternative Exchange Rate & Factor Cost Distributions

Supply Chain Network Model Outcome for Each Combination

Expected Outcomes

Best Configuration for Current Exchange Rate and Factor Costs

K
Local Pricing Strategy
Accounting for risk in both market demand and prices/exchange rate risk, the option value of managerial flexibility can be captured.

Forecast: Total After-Tax Profit (13a)
150 Trials
Frequency Chart
1 Outlier

Forecast: Total After-Tax Profit (13b)
150 Trials
Frequency Chart
1 Outlier

Forecast: Total After-Tax Profit (13c)
150 Trials
Frequency Chart
0 Outliers

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Page: 14

6 plants open
5 plants open
Optimal!
3 plants open
Five-Stage Approach to Strategy Development

Stage 1: Business and Operations Strategy and Plant Charters

Global Market

Strengths

Cross-Sectional Data

Market Presence and Capabilities

Infrastructural Requirements

Logistics Costs

Stage 2: Multiple-Technology Scale Curves

Competitive Environment

Process Technologies

Internal Constraints

Supplier Industries

Stage 3: Major Network Options

Political and Market Issues

Factor Costs

Stage 4: Location and Process Options

Stage 5: Modeling
Summary

• Methods for analyzing focus, scale flow, etc.
• Impact of new markets and technologies
• Global product design and flow patterns
• Flexibility
• Factor costs
• Other things we need to consider in more detail
  – Outsourcing and offshoring questions in globalization
  – Longer lead times
For those of you interested in details, formulation for general case

\[
\sum_k y_{ikl} \leq A_{il}
\]

\[
\sum_{j,l} x_{lkjf} \leq A_k
\]

where \( f \) is the unit usage of product \( l \)

\[
\sum_k x_{lkj} \geq D_{lj}
\]

\[
\sum_i y_{ikl} \geq \sum_j x_{lkj}
\]

\[
\sum_{lj} x_{lkj} \leq k z_{kj}, z_{kj}
\]

is zero or one, forcing constraint

Could also have shared cap at plants. With no warehouses, define plant variables to go to customers directly. Can add another level for sourcing or two stages of plants.