

Defense Supply Chain Management

[REDACTED]

¹Naval Postgraduate School
Graduate School of Business and Public Policy

[REDACTED]

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July 9-10, 2013

Class Agenda

- 1 Introductions
- 2 Syllabus
- 3 Intro to SCM
- 4 Forecasting

Agenda

- 1 **Introductions**
 - A Supply Chain Poem
 - About Me
 - About you
- 2 Syllabus
- 3 Intro to SCM
- 4 Forecasting

“A Quiet Life” by Baron Wormser

What a person desires in life
is a properly boiled egg.

This isn't as easy as it seems.

There must be gas and a stove,
the gas requires pipelines, mastodon drills,
banks that dispense the lozenge of capital.

There must be a pot, the product of mines
and furnaces and factories,
of dim early mornings and night-owl shifts,
of women in kerchiefs and men with
sweat-soaked hair.

Then water, the stuff of clouds and skies
and God knows what causes it to happen.

There seems always too much or too little
of it and more pipelines, meters, pumping
stations, towers, tanks.

“A Quiet Life” by Baron Wormser

And salt-a miracle of the first order,
the ace in any argument for God.

Only God could have imagined from
nothingness the pang of salt.

Political peace too. It should be quiet
when one eats an egg. No political hoodlums
knocking down doors, no lieutenants who are
ticked off at their scheming girlfriends and
take it out on you, no dictators
posing as tribunes.

It should be quiet, so quiet you can hear
the chicken, a creature usually mocked as a type
of fool, a cluck chained to the chore of her body.
Listen, she is there, pecking at a bit of grain
that came from nowhere.

[Redacted]

[Redacted]

- [Redacted]

Tell me about you!!!

Agenda

1 Introductions

2 Syllabus

- Key Concept
- Objectives
- Learning Experiences
- Requirements

3 Intro to SCM

4 Forecasting

Syllabus

Key Concept of the Course

Key Concept: To mold each other into expert interrogators who understand the underlying equations behind the supply chain, appreciate the monetary effects on the organizations in the supply chain, and empathize with the people who run and work throughout the supply chain

- Thinking about people (Sociology)
- Thinking about money (Economics)
- Thinking about the equations that drive the supply chain (Mathematics)

Syllabus

Objectives

- Describe SCM and its **mission** in terms of the management, location, and movement of materials.
- Define, describe, and utilize **concepts and performance measures** fundamental to SCM, such as risk pooling, the bullwhip effect, vendor-managed inventory, and Radio Frequency Identification (RFID).
- Analyze **complex problems** that involve multiple concepts and make sound recommendations based on these critical thinking using mathematics, economics, and sociology.
- Understand the tradeoffs involved in **designing** and **implementing** different types of supply chain layouts.
- Understand the **strategic** SCM issues and their relationships with other areas of the organization.

- **Hands-on experiential exercises**, including simulations, in-class games, and exercises that explore dynamics and behavior. You may feel uncomfortable with this approach at first. The point of these exercises is that you make the same mistakes that many of your commanding officers make in the field.
- **Technical/mechanics of application**, including review problems solved inside and outside of class and hands-on work with spreadsheets. Group problems and individual problems.
- **Discussion and demonstration of applied examples**, including application of concepts to real-world scenarios and in-class case discussions that do not necessarily have a “write-up,” and “active learning,” where each student discusses a topic with another student for a set time and engages in class discussion afterwards.
- **Analysis and application of concepts**, including case studies that do require “write-up,” individual interactions, and discussions.

Syllabus

Requirements

- A take-home final exam.
- Consistent classroom attendance and active, skilled participation, both in class and out of class. This includes communication with the professor and your fellow students and engagement online.
- Two Supply Chain Game (SCG) Simulation Debriefs: A ten-minute PowerPoint presentation in class describing the thought process behind your decisions and how you would improve if you played again.
- Two homework assignments.
- Two case study write-ups: submit two group write-ups based on Harvard Case Studies.
- A self-evaluation: “make a case” for receiving a particular grade using criteria provided in class and citing evidence from your work across the quarter.

Syllabus

Requirements (Grades)

- **Final Exam:** (about 30%)
- **SCG Debriefs:** (about 20%)
- **Sport Obermeyer Case:** (about 10%)
- **Quad Case:** (about 10%)
- **Homework (2):** (about 10%)
- **Active, Skilled Participation:** (about 20%)

Syllabus

Requirements (Grades)

Grading Profile for an “A”: *Excellence overall, no major weaknesses*
Exemplary performance implies excellence in grasping what holistic supply chain management thinking is. The work at the end of the course is, on the whole, clear, precise, logical, and well-reasoned. The student usually distinguishes the relevant from the irrelevant, usually recognizes key assumptions, both questionable and necessary, usually is able to clarify key concepts effectively, usually is able to identify multiple competing and relevant points of view, and usually is sensitive to important implications and consequences of decisions. A-level work displays excellent reasoning and problem solving skills as well as a depth of insight.

Syllabus

Requirements (Thinking)

What is Critical Thinking?

<http://www.criticalthinking.org/ctmodel/logic-model1.htm#>

Syllabus

Requirements (What to expect)

I expect you to work hard in this class. You should expect me to work hard in this class. I expect you to be in class on time. You should expect me to start class on time and end class on time. I expect you to learn this quarter. I, too, will learn this quarter. I expect you to come to me if there is any problem with class. You should expect me to come to you if I see any problems during the quarter. I expect you to have fun with this learning experience. I promise you that I will have fun teaching you!

Syllabus

Requirements (Schedule)

| Week | Tuesday | Wednesday | Topic | Readings | Assignment Due Dates |
|------|----------|-----------|---|--|----------------------|
| 1 | 07/09/13 | 07/10/13 | Intro to Supply Chain Management | CM: pp. 1-18 (Chapter 1) CM: pp. 19-36 (Chapter 2) CM: pp. 38-59 (Chapter 3) | |
| | | | Demand Forecasting | CM: pp. 178-183 (Chapter 7.1-7.4) CM: pp. 188-189* (Chapter 7.5 Moving Average Only) CM: pp.193-195 (Chapter 7.6) | |
| | | | Fighting Falcon (A) Normal Curve | Online CM: pp. 354-355 (Appendices 12A/12B) | |
| 2 | 07/16/13 | 07/17/13 | Inventory Management and Risk Pooling | CM: pp. 271-308 (Chapter 11) CM: pp. 314-347 (Chapter 12) CM: pp. 358-387 (Chapter 13) | |
| | | | Analyzing a Case Study Introduction to Supply Chain Game Fighting Falcon (B) | Online Online Online | |
| 3 | 07/23/13 | 07/24/13 | Inventory Management and Risk Pooling (Continued) | | SCG Meeting |
| 4 | 07/30/13 | 07/31/13 | Network Planning | CM: pp. 68-85 (Chapter 4.1-4.3) CM: pp. 108-134 (Chapter 5) | |
| | | | Supply Chain Game (Round 1) (week-long) | Online | |
| 5 | 08/06/13 | 08/07/13 | Supply Chain Game Debrief / Intro to Round 2 | | Debrief Due |
| 6 | 08/13/13 | 08/14/13 | In Class: The Beer Game | Online | HW 1 due |
| 7 | 08/20/13 | 08/21/13 | Barilla Spa (A) Network Planning | Harvard Case CM: pp. 68-85 (Chapter 4.1-4.3) CM: pp. 108-134 (Chapter 5) | SCG Meeting |
| 8 | 08/27/13 | 08/28/13 | Value of Information Sport Obermeyer Transportation Procurement and Outsourcing Supply Chain Game (Round 2) (week-long) | CM: pp. 250-269 (Chapter 10) Harvard Case CM: pp. 397-419 (Chapter 14.1-14.5) CM: pp. 428-441 (Chapter 15.1-15.4) Online | Case Write-up due |
| 9 | 09/03/13 | 09/04/13 | Supply Chain Game Debrief | | Debrief Due |
| 10 | 09/10/13 | 09/11/13 | Hewlett-Packard Co. Deskjet Printer Supply Chain (A) Technology Standards: RFID | Harvard Case CM: pp. 488-498 (Chapter 17) | HW 2 due |
| 11 | 09/17/13 | 09/18/13 | Quad Wants To Be a Savi Player in Agribusiness | Online | Case Write-up due |

* Moving Average

Agenda

- 1 Introductions
- 2 Syllabus
- 3 Intro to SCM
 - The Basics
 - Fit & Scope
 - Metrics
- 4 Forecasting

Intro to SCM

The Basics

What is Supply Chain Management?

- All stages involved, directly or indirectly, in fulfilling a customer request
- Includes manufacturers, suppliers, transporters, warehouses, retailers, and customers
- Within each company, the supply chain includes all functions involved in fulfilling a customer request (product development, marketing, operations, distribution, finance, customer service)
- Customer is an integral part of the supply chain
- Includes movement of products from suppliers to manufacturers to distributors and information, funds, and products in both directions

Intro to SCM

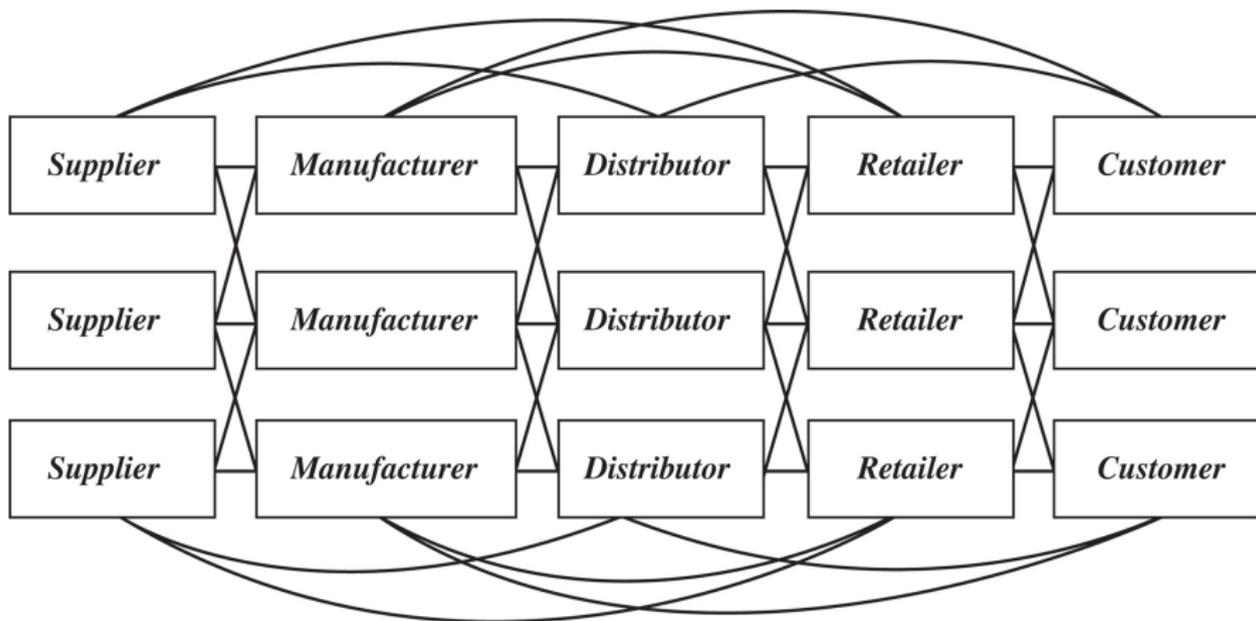
The Basics

What is Supply Chain Management?

- May be more accurate to use the term “supply network” or “supply web”
- Typical supply chain stages: customers, retailers, distributors, manufacturers, suppliers
- All stages may not be present in all supply chains (e.g., no retailer or distributor for Dell)

Intro to SCM

The Basics



Intro to SCM

The Basics

Effective SCM: management of flows between and among supply chain stages to maximize total supply chain *surplus*

Active Learning¹

How is the military supply chain different from the traditional supply chain?

¹Discuss in groups of two-three for two minutes

Intro to SCM

Supply chain strategy or design: How to structure the supply chain over the next several years

Supply chain planning: Decisions over the next quarter or year

Supply chain operation: Daily or weekly operational decisions

Intro to SCM

The Basics

Strategy or Design

- Decisions about the structure of the supply chain and what processes each stage will perform
- Strategic supply chain decisions
 - Locations and capacities of facilities
 - Products to be made or stored at various locations
 - Modes of transportation
 - Information systems
- Supply chain design must support strategic objectives
- Supply chain design decisions are long-term and expensive to reverse—must take into account market uncertainty

Intro to SCM

The Basics

Planning

- Definition of a set of policies that govern short-term operations
- Fixed by the supply configuration from previous phase
- Starts with a forecast of demand in the coming year
- Decisions
 - Who supplies whom
 - Planned buildup of inventory (seasonality)
 - Subcontracting
 - Inventory Policies
 - Timing and size of price promos
- Must consider in planning decisions demand uncertainty, exchange rates, competition over the time horizon, etc.

Intro to SCM

The Basics

Operation

- Weekly or daily time horizon (less uncertainty)
- Decisions regarding individual customer orders
- Supply chain configuration is fixed and operating policies are determined
- Goal is to implement the operating policies as effectively as possible
- Possible actions
 - Allocate orders to inventory or production
 - set order due dates
 - allocate an order to a particular shipment
 - set delivery schedule
 - place replenishment orders

Intro to SCM

Fit & Scope

Competitive Strategy: the set of customer needs a firm seeks to satisfy

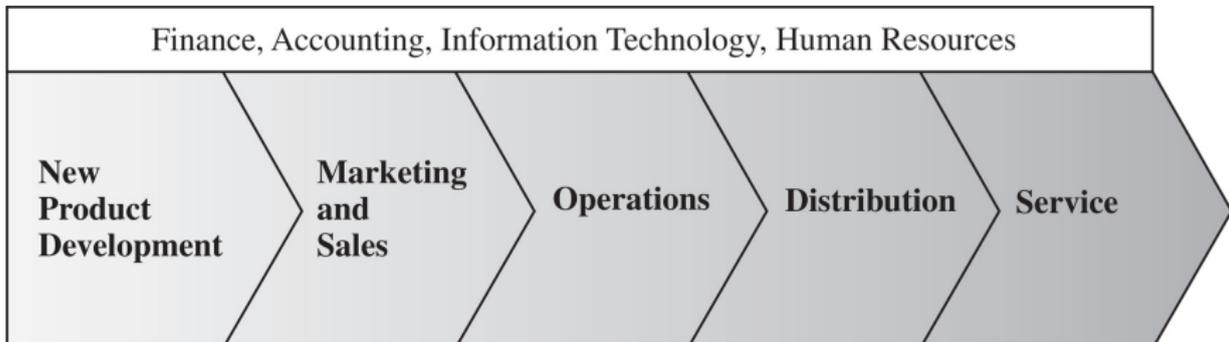
Supply Chain Strategy: the nature of material procurement, transportation of materials, manufacture of product or creation of service, distribution of product

Strategic Fit: Supply Chain Strategy aligns with Competitive strategy

Intro to SCM

Fit & Scope

The Value Chain



Is this the value chain of the military? What is the US military's competitive strategy?

Intro to SCM

Fit & Scope

Steps To Achieving Strategic Fit

- 1 Understand the customer and supply chain uncertainty
- 2 Understand the supply chain ability
- 3 Achieve Strategic Fit

Intro to SCM

Fit & Scope

Steps To Achieving Strategic Fit

- 1 Understand the customer and supply chain uncertainty
 - Quantity of product needed in each lot
 - Response time customers will tolerate
 - Variety of products needed
 - Service level required
 - Price of the product
 - Desired rate of innovation in the product
 - Implied demand uncertainty
- 2 Understand the supply chain ability
- 3 Achieve Strategic Fit

Intro to SCM

Fit & Scope

Steps To Achieving Strategic Fit

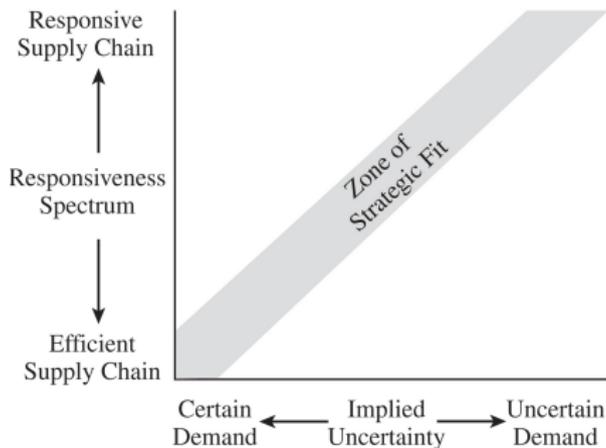
- 1 Understand the customer and supply chain uncertainty
- 2 Understand the supply chain ability
 - to respond to wide range of quantities demanded
 - meet short lead times
 - handle large variety of products
 - build innovative products
 - meet high service level
 - handle supply uncertainty
- 3 Achieve Strategic Fit

Intro to SCM

Fit & Scope

Steps To Achieving Strategic Fit

- 1 Understand the customer and supply chain uncertainty
- 2 Understand the supply chain ability
- 3 Achieve Strategic Fit



Intro to SCM

Fit & Scope

| | Efficient Supply Chains | Responsive Supply Chains |
|-------------------------|--|---|
| Primary goal | Supply demand at the lowest cost | Respond quickly to demand |
| Product design strategy | Maximize performance at a minimum product cost | Create modularity to allow postponement of product differentiation |
| Pricing strategy | Lower margins because price is a prime customer driver | Higher margins because price is not a prime customer driver |
| MFG strategy | Lower costs through high utilization | Maintain capacity flexibility to buffer against demand/supply uncertainty |

Intro to SCM

Fit & Scope

| | Efficient Supply Chains | Responsive Supply Chains |
|--------------------|---|--|
| Inventory strategy | Minimize inventory to lower cost | Maintain buffer inventory to deal with demand/supply uncertainty |
| Lead time strategy | Reduce, but not at the expense of costs | Reduce aggressively, even if the costs are significant |
| Supplier strategy | Select based on cost and quality | Select based on speed, flexibility, reliability, and quality |

Intro to SCM

Fit & Scope

Scope of strategic fit:

the functions within the firm

and

stages across the supply chain that devise an integrated strategy with an aligned objective

Key concept: Firms don't compete, supply chains compete. This is a highly evolved view of supply chains.

Active Learning

Does the US military have an integrated strategy across the different stages of its supply chain?

Intro to SCM

Metrics

Drivers of Supply Chain Performance

- ***Facilities:** The physical locations in the supply chain network where product is stored, assembled, or fabricated
- ***Inventory:** All raw materials, work in process, and finished goods within a supply chain
- ***Transportation:** Moving inventory from point to point in the supply chain
- **Information:** Data and analysis concerning facilities, inventory, transportation, costs, prices, and customers throughout the supply chain
- **Sourcing:** Who will perform a particular supply chain activity
- **Pricing:** How much a firm will charge for the goods and services that it makes available in the supply chain

Intro to SCM

Metrics

Facilities

- Flexible or dedicated
- product or functional
- location
- capacity (excess or tight)
- **Metrics:** Capacity, Utilization, down time, processing time, production cost per unit, quality losses, cycle time, flow time
- **Trade-off:** responsiveness vs. efficiency
 - Increasing number of facilities increases facility and inventory costs, decreases transportation costs and reduces response time. Why?
 - Increasing the flexibility or capacity of a facility increases facility costs, decreases inventory costs and response time. Why?

Intro to SCM

Metrics

Inventory

- Mismatch between supply and demand
- Little's Law: $I = DT$
- Role:
 - Form, location, and quantity of inventory allow a supply chain to range from being very low cost to very responsive
 - Objective is to have right form, location, and quantity of inventory that provides the right level of responsiveness at the lowest possible cost
- **Types:** Cycle Inventory, Safety Inventory, Seasonal Inventory
- Inventory Trade-off Curve
- **Metrics:** Average Inventory, Turns, Days of Inventory, Batch Size, Inventory Holding Cost, Average Safety Inventory, Fill Rate, etc.

Intro to SCM

Metrics

Active Learning

How does the military measure its inventory?

Intro to SCM

Metrics

Transportation

- **Role:** Moves things
- **Trade-off:** responsiveness / efficiency — fast modes : raise responsiveness and transportation cost but lowers the inventory holding cost
- Affects inventory and facilities
- **Design:** Modes, Locations, routes, Direct or consolidated, milk runs
- **Metrics:** Average cost (per unit, per shipment), Average size

Agenda

- 1 Introductions
- 2 Syllabus
- 3 Intro to SCM
- 4 **Forecasting**
 - Overview
 - Moving Average
 - Forecast Error
 - Fighting Falcon

Forecasting

Overview

Role of Forecasting: Basis for all planning decisions in the supply chain

Production scheduling, inventory, aggregate planning, Sales force allocation, promotions, new production introduction, Plant/equipment investment, budgetary planning, Workforce planning, hiring, layoffs

Forecasting

Overview

“To Forecast is to Err”
- Jack Muckstadt (by way of
William Shakespeare)

Forecasting

Overview

- **ALL** Forecasts are inaccurate; generate both expected value and a measure of forecast error
- Long-term forecasts are usually less accurate than short-term forecasts
- Aggregate forecasts are usually more accurate than disaggregate forecasts

Forecasting

Overview

Must identify factors that influence future demand then ascertain the relationship between these factors and future demand

- Past demand
- Lead time of product replenishment
- Planned advertising or marketing efforts
- Planned price discounts
- State of the economy
- Actions that competitors have taken

Forecasting

Overview (Methods)

- 1 **Qualitative:** Subjective, Judgment
- 2 **Time Series:** Use historical demand, best when stable
- 3 **Causal:** Some other factor
- 4 **Simulation:** Run scenarios

Observed Demand = Systemic Component + Random Component

Systemic: Expected Value (Level, Trend, Seasonality)

Random: Variable (impossible to predict)

Forecast error: Difference between forecast and actual

Forecasting

Overview (Example)

Short Term Forecasting

Prepare daily demand forecasts for next 28 days for thousands of items, as well as forecast accuracy estimates.

Forecast updated weekly on a rolling basis

Solution: Implement time series methods in Excel.

Forecasting

Moving Average

- Used when demand has no observable trend or seasonality
- Systematic component of demand = level
- The level in period t is the average demand over the last N periods

$$L_t = \frac{D_t + D_{t-1} + \dots + D_{t-N+1}}{N}$$

$$F_{t+1} = L_t \text{ and } F_{t+n} = L_t$$

After observing the demand for period $t + 1$, revise the estimates

$$L_{t+1} = \frac{D_{t+1} + D_t + \dots + D_{t-N+2}}{N}$$

$$F_{t+2} = L_{t+1}$$

Forecasting

Moving Average(Example)

$D_7 = 10, D_8 = 20, D_9 = 25, D_{10} = 30, D_{11} = 20, D_{12} = 40$

What is F_{13} and F_{14} when $N = 2$? $N = 3$?

Forecasting

Forecast Error

Important Lesson: ALWAYS SAVE YOUR FORECASTS!!!!
 Why?

Mean Absolute Deviation

$$MAD_n = \frac{1}{n} \sum_{t=1}^n |F_t - D_t|$$

Estimate for Standard Deviation

$$\sigma \approx 1.25 * MAD$$

Forecasting

Fighting Falcon

Fighting Falcon Case A