Draft Syllabus
Supply Chain Management OPNS-455
Fall 2019 - Section 61

Class Time:  Monday / Thursday, 10:30 am - Noon

Instructor:  Sunil Chopra
E-mail: s-chopra@kellogg.northwestern.edu
Phone: 847-491-8169

Office Hours:  Wednesday 10 am – noon (or by appointment) in 4155

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## 0. Course Outline

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1. Course Description and Objectives

Supply chain management is unique and, to some degree, represents a paradox because it is concerned with one of the oldest and also the most newly discovered activities of business. Supply chain activities - inventory management, warehousing, sourcing, communication, transportation, and facility location - have been performed since the start of commercial activity. It is difficult to visualize any product that could reach a customer without logistical support. Yet it is only over the last few years that firms have started focusing on supply chain management as a source of competitive advantage. There is a realization that no company can do any better than its supply chain. This becomes even more important given that product life cycles are shrinking and competition is intense. Supply chain management today represents a great challenge as well as a tremendous opportunity for most firms.

Other terms that have recently appeared in the business jargon are demand chain, value chain, and value stream. We will use the phrase supply chain management to cover all these ideas.

In this course we view the supply chain from the point of view of a general manager. Supply chain management is all about managing the hand-offs in a supply chain - hand-offs of information, product, or funds. The design of a supply chain is critically linked to the objectives of the supply chain. Our goal in this course is to understand how supply chain design and planning decisions impact the performance of the firm as well as the entire supply chain. The key will be to understand how different supply chain structures are suitable for different product and customer characteristics and strategic objectives of the firm.

2. Grading and “Rules of the Game”

Submission cases and assignments will account for 60% of the grade. There will be four full case write-ups due during the quarter. Each case write-up is due in groups. Please keep group sizes to at most five. There will be two inventory assignments that are to be done individually. Each inventory assignment consists of two problems and should not be very time consuming. The objective is to give each of you an opportunity to test your analytical ability with spreadsheets for inventory problems. The first submission (case write-up) is due at the start of week 2 on September 26. Please read the Guidelines for Written Case Analyses on p. 11 of this syllabus and try to structure your reports accordingly. A final peer review will be done on group work.

A final project will account for 20% of the grade. The final project offers an opportunity to apply course concepts and to perform an in-depth analysis of supply chain issues that are of interest to you. The final project is meant to complement the learning from the cases. The cases have a strong quantitative basis. Most projects tend to have a descriptive and conceptual basis. Please read the Guidelines for Final Project on p. 12-14 of this syllabus.

A final exam will account for 20% of the grade. The final exam will be in class, closed book. It will consist of a series of short conceptual questions. The primary objective is for you to review all concepts in class one last time. It will be administered during the regular exam period. A sample exam will be available on the course home page.

Each group (not individual) is expected to have at least one "meaningful" posting during the term on the discussion board.
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<thead>
<tr>
<th>Grade Component</th>
<th>Individual / Group</th>
<th>Weight</th>
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<tr>
<td>Submission Cases (3 full)</td>
<td>Group plus Peer Review</td>
<td>36 %</td>
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<td>Individual mini-cases (3)</td>
<td>Individual</td>
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<td>Final Project</td>
<td>Individual or Group plus Peer Review</td>
<td>20 %</td>
</tr>
<tr>
<td>Final Exam</td>
<td>Individual</td>
<td>20 %</td>
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When you are in class, you are expected to fully follow the principles of the Kellogg code of classroom etiquette (http://www.kellogg.northwestern.edu/stu_aff/policies/etiquette.htm). Three important etiquette aspects in my class are:

1. All cell phones must be turned off before the start of class.
2. The computer should only be used to take class notes. All other programs should be shut down before the start of class. Any chatting, web surfing, e-mail etc. disturbs the class and is a breach of classroom etiquette. All computer users should make sure to be seated in the last row of the class.
3. Please make sure to come and be seated in class by 10.29 am.

The Kellogg Honor Code applies as follows:

- **Submission cases** may not be discussed with anyone outside your study group. You may not refer to any reports or spreadsheets from past classes. **It is extremely important and part of the honor code that each member of a group contributes to each case analysis of the group. If any individual has not contributed for a particular write-up, s/he should not append his/her name to the case report but submit a separate report his/her own.** It will also be the group’s responsibility to ensure that this happens. Only one written report will be due per group per assignment. However, as I have stressed, each member must contribute to the analysis leading to the report.

- **Final projects**: You should make it very clear what part of your write-up is based on your own thinking and what part summarizes pre-existing outside sources. Thus, it is extremely important and part of the honor code that you explicitly identify and refer to all significant external sources (e.g. in footnotes or endnotes) that you build on in your report. This applies in particular to papers you may have written for other Kellogg classes, to documents you may have received from the company you are analyzing, interviews with industry experts, etc. Building on external sources is a “good thing” – solid work is typically aware of and builds on what others have done. Ideally though, you should take this external information and add the filter of your own critical thinking and the concepts studied in this class to synthesize it, critique it, etc.

- **Final exam**: It is to be done completely on your own and may not be discussed with anyone.

- For standard violations of academic integrity, please check out a description of some of the standard violations at [http://www.northwestern.edu/uacc/defines.html](http://www.northwestern.edu/uacc/defines.html)

- For a detailed discussion on plagiarism by the Northwestern Undergraduate Academic Conduct Committee, please see [http://www.northwestern.edu/uacc/plagiar.html](http://www.northwestern.edu/uacc/plagiar.html)

- **Peer reviews**: Your grades will take into account a peer review from each group member of other members in your group. Forms will available on the course home page.
3. Course Materials and other Readings

- The course packet and the textbook *Supply Chain Management: Strategy, Planning, and Operations* by S. Chopra (SC), 7th Edition (ISBN 978-0-13-473188-9). Please feel free to get a different edition if you prefer (as long as you can cross reference existing material and follow any missing material in class). I will make sure that any cases/assignments from the 6th edition are posted on blackboard.

Some other textbooks on the subject that may be of interest:

3. *Inventory Management and Production Planning and Scheduling* by Edward A. Silver, David F. Pyke, and Rein Peterson
4. *Business Logistics Management* by Ronald H. Ballou

Other business books that may be of interest to students taking this course:

2. *Clock Speed* by Charles H. Fine
5. *Towards a Better Supply Chain* by Charles C. Poirier
6. *Time Based Competition* by Joseph D. Blackburn
7. *Competing Against Time* by George Stalk, Jr. and Thomas H. Hout
8. *The Box: How the shipping container made the world smaller and the world economy bigger* by Marc Levinson
9. *Balanced Sourcing* by Timothy M. Laseter
4. Topics, Schedule and Assignments

- **All cases must be read before the class** they are to be discussed in (whether a submission is required or not).
- Lectures will follow the book (SC). Chapters from SC are assigned as background reading with the material being covered. The **book chapters are best read right after the lecture** to reinforce the concepts discussed. The book also provides technical details that may not be discussed in class.

The cases and readings to be covered are specified below for each week.

*A Strategic Framework to Analyze Supply Chains (Classes 1-3)*

**Class 1:** Read Chapter 1 of SC.

We define supply chain management and discuss its importance to the success of a firm. We discuss different views of a supply chain and raise a variety of supply chain related questions that need to be answered by any firm.

**Class 2:** Read Chapter 2 of SC (Read Chapter 3 after class). Be prepared to discuss the Seven Eleven Japan case (Pages 60-66 of SC).

Supply chain decisions are divided into three categories - strategic/design, planning, and operational. We develop a framework within which supply chain decisions may be analyzed and appropriate tradeoffs considered. The framework links the strategic objectives of the firm to key supply chain drivers that can be used to affect supply chain performance. We illustrate the strategic framework for supply chain decisions in the context of the Seven Eleven Japan case. We will introduce the notion of Tailored Supply Chains and its importance in today’s environment.

**Discussion Case:** Seven Eleven Japan (pages 60-66 of SC). Consider the questions at the end of the case.

**Class 3:** Submit CaLNG report.

We apply the framework to the CaLNG case and use it as a context to consider simple tradeoffs in supply chain design. Submit a report on the CaLNG case. Use the questions in the case when preparing your case report. **Please write a report as described under case write ups. Do not simply answer the questions.**

*Designing the Supply Chain Network (Classes 4-6)*

**Class 4:** Read Sections 4.1 - 4.3 of SC. be prepared to discuss the Blue Nile & Diamond Retailing case.

This session will start with a discussion linking the supply chain drivers to the financials of a firm. The goal here is to understand the financial impact that supply chain improvements have on the value of the firm.

We use the Blue Nile case to discuss relevant issues in designing a supply chain network. Our objective will be to optimally structure the distribution network, taking into account cost and customer service factors. The discussion starts at a high level using Chapter 4 in SC. The goal is to identify factors that influence supply
chain design and some basic design principles. We then introduce the concept of the ROIC tree to compare performance of Tiffany and Blue Nile.

**Discussion Case:** *Blue Nile & Diamond Retailing (pages 102-107 of SC).* Consider the questions at the end of the case.

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**Class 5:** Read Chapter 5 (Read sections 6.1-6.5 after class) of SC.

We develop a framework for facility location decisions that allows for a multi-plant, multi-warehouse network to supply a large and diverse customer base. We use Excel workbooks to discuss various models for network design. All workbooks can be accessed from the course home page via the link *Designing the Supply Chain Network: Facility Decisions.*

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**October 7 (Tutorial):** This tutorial focuses on building network design models that are used in Chapter 5. In particular, we build a model for the CoolWipes case study (pages 141-2 of C&M). This tutorial is useful for people that do not have a lot of experience with Solver. Content of the tutorial will be helpful in modeling the BioPharma cases as well.

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**Sales & Operations Planning in a Supply Chain – Seasonal Inventory (Classes 6-7)**

**Class 6:** Skim Chapters 7 and 10 of SC.

We finish network design by discussing how uncertainty (demand, exchange rate, etc.) is accounted for in network design. This allows us to evaluate capacity and flexibility as real options.

The network in a supply chain defines the resources available. The design decisions are updated infrequently and tend to stay in place for years. On a more regular basis (monthly or quarterly), management must make decisions regarding the near term use of these resources. In this session we play the beer game that sets up our discussion of sales and operations planning (S&OP) in a supply chain. Please bring your laptop to class to participate in the online beer game.

**Class 7:** Submit *BioPharma Inc.* case report (pages 174-177 of SC). Skim Chapters 8-10 in SC (read carefully after lecture)

In this session we continue discussing concepts and methodologies associated with sales and operations planning in a supply chain. In particular, we focus on coordinating promotions across the supply chain. An important exercise is to forecast demand and then plan the use of resources, outsourcing, buildup of inventories, as well as future actions (such as promotions) that impact expected demand. We discuss seasonal inventory in this setting.

You can access the interactive Excel workbooks associated with sales and operations planning examples in chapters 8 - 9 of SC from the course page.

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**Managing Cycle Inventory in the Supply Chain (Classes 8-9)**

**Class 8:** Submit all project proposals; Skim Chapter 11 of SC (read carefully after lecture)

All project proposals are due in this class. We start discussion on the management of inventory in the supply chain to ensure fit with stated strategic goals. Our goal is to understand the buildup of cycle inventory
and *managerial actions that can improve supply chain performance* in terms of cycle inventory. Building on the EOQ model, we discuss approaches to reduce cycle inventory without hurting cost. Read Chapter 11 in *C&M* and play with the interactive Excel workbooks associated with examples in this chapter: you can access these from the course home page.

**Class 9:** Read Chapter 11

We finish discussion on cycle inventory in the supply chain (Chapter 11 of SC). We focus on the *link between cycle inventory and pricing*. We discuss the *effect of volume discounts and short term discounts* on order sizes and thus inventory and cycle times in the supply chain.

**Managing Safety Inventory and Availability in the Supply Chain (Classes 10-13)**

**Class 10:** Submit KAR Foods (SC) as an individual assignment; Read Sections 12.1 – 12.3 (read the rest of the chapter after class)

We discuss the role of safety inventory. We discuss various *measures of customer service* such as cycle service level and fill rate and derive precise *relationships between these customer service measures and safety inventory*. We then discuss various managerial levers for decreasing safety inventory. Our goal is to identify *strategies* that allow a supply chain to *provide high variety at reasonable costs*.

You can access the interactive Excel workbooks associated with examples in this chapter from the course home page.

**Class 11:** Read Chapter 12

We finish the discussion on pooling and postponement. A key objective is to understand the role of *pooling inventories in the face of independent demands* and how this understanding can be used strategically to construct innovative business models, as well as to improve operations. We discuss a variety of business models that rely on this ability to pool uncertainty.

**October 26 tutorial:** This optional tutorial focuses inventory models.

**Class 12:** ALKO case (pages 351-353 of Chapter 12 in SC). Read Chapter 13.

Submit a report on the ALKO case (end of Chapter 12 in SC). We discuss the *ALKO* case (at the end of Chapter 12 in *C&M*) to identify various *factors that affect the organization of inventories within the distribution system*. The case illustrates the inventory, transportation, and facility tradeoffs when designing a supply chain. We use this to discuss a framework for Omni-channel retailing.

We then discuss *how a firm selects the appropriate level of service* to provide customers. You can access the interactive Excel workbooks associated with examples in chapter 13 of C&M from the course home page. Based on an understanding of the tradeoffs involved in setting the *optimal level of availability*, we discuss actions a manager can take to improve supply chain profitability.

**Class 13:** Submit *Should Packaging be Postponed to the DC?* from SC as an individual assignment.

We finish discussion of actions a manager can take to improve supply chain profitability.
**Sourcing in the Supply Chain (Classes 14-15)**

**Class 14:** Read Chapter 15 in SC (Only sections 15.1-15.5, 15.8, 15.9)

We develop a framework that managers can use to think about sourcing decisions (Chapter 15 of SC). An important question is whether to outsource or not. We discuss this question in the context of the Contract Manufacturing Industry. We discuss the role played by intermediaries such as Li & Fung.

**Class 15:** Submit *A need for speed at winner apparel* from SCM as an individual assignment

We build a framework for off-shoring, near-shoring and on-shoring decisions in the context of Polaris Industries. We close with a framework for tailored sourcing. Some of these ideas will be discussed in the context of the fast fashion industry.

**Class 16:** Guest speaker

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**Managing Transportation in the Supply Chain (Class 17)**

**Class 17:** We discuss the role of transportation in the supply chain and raise various tradeoffs involved in designing and operating a transportation network (Chapter 14 of C&M). We will discuss the different transportation modes available. We will motivate the link between transportation and inventory costs in the design of transportation networks. We will also consider different problems that are relevant when making transportation decisions.

In the context of cross-docking and transit points we will also discuss the Bombay Dabbawallahs. How are they able to run such a responsive system so cheaply? How is their distribution system structured? What characteristics of the system (besides low labor cost) facilitate its performance? We then extend the discussion to various efforts around same day delivery in the United States in the context of the case “The future of same–day delivery: Same as the past?” We also discuss the notion of Tailored Transportation and its applications.

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**Managing Risk in the Supply Chain**

**Class 18:** Read sections 6.6 and 15.6

We will discuss different aspects of supply chain risk and suitable mitigation strategies. In particular we will focus on a comparison of recurrent and disruption risk. We will discuss the sharing of risk in the context of how different contracts and incentive plans in the supply chain affect the behavior at different stages. For example, in the book industry publishers take back all unsold books. Is this a good idea or not? Should all industries implement such a plan? Movie studios have gone from charging high upfront fee for videos to charging low upfront fee and sharing revenue from the rental. Is this a good idea or not? We will introduce ideas that are important when designing supply chains to deal with disruption risk.
Supply Chain Design

Class 19: Read the “W.W. Grainger” case

We will wrap up the course and bring together several frameworks in the context of the W.W. Grainger and Groceries Case (case packet). Prepare to discuss the various business models and their strengths and weaknesses. We discuss pros and cons of different supply chain designs and their impact on the financial performance of different firms.

Class 20: Project presentations

Three groups (selected in week 4) will make project presentations. Each group should plan on a 20-25 minute presentation. The presenting groups should send their presentations electronically to me.

Class 21: In class final exam.

The final exam is designed to test your understanding of the main concepts and not your ability to memorize vast amounts of information. If you are sailing along throughout the quarter, preparation for the exam should require very little time. A sample final exam is available on the course home page.
5. Guidelines for Written Case Analyses

The reports are graded for both content and presentation. A good paper should clearly and succinctly state the recommendations in the first paragraph to provide the reader with a framework. (If a lengthy description of the recommendation seems necessary, append it to the report.) The remaining paragraphs should each present a major part of the rationale for the recommendation in terms of the desirable and undesirable consequences of adopting it. The rationale must consider capabilities that the logistics system under study needs to excel at, and how the current system either provides these capabilities or fails to provide them.

Some common problems in preparing reports result from inadequate analysis. Analysis for a report is a time consuming and intellectually challenging task. Each case has a set of questions which are a guide to help you with the analysis – however, you should not limit your analysis to narrowly answering these questions. The objective is to evaluate a complete range of alternatives and anticipate and discuss the full consequences of your recommendation.

A good report is not a chronology of analysis, but a clearly articulated statement of recommendation and support. If there are options under consideration in the case that are rejected by you, a clear rationale for your decision should be provided. Facts stated in the case need not be restated unless used to make a point. I will assume that the most important issues are raised in the report and that all else is less important to the writer. Both desirable and undesirable consequences should be factually stated and supported. In the overall evaluation of the report the discussion of all consequences of the recommendation is of the greatest importance. You must clearly discuss how your recommendations aid in the development of capabilities that are important for the logistics system under study.

As per the honor code, an individual should include his/her name on a report only if they have contributed to the analysis. A peer evaluation will be collected at the end of the term and used for grades.

The following table summarizes deadlines, submission and formatting guidelines.

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<th>Written Case Analyses: Deadlines, Submission and Format Guidelines</th>
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<tr>
<td>• Written case analyses are due at the beginning of the class session for which they are assigned.</td>
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<td>• Late assignments are not acceptable - no credit will be given.</td>
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<tr>
<td>• Submit a hardcopy of your analysis in class – one per group.</td>
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<tr>
<td>• Length &amp; format: Typed, double-spaced and about 3 to 4 pages, not including appendices and exhibits. Exhibits need not be typed but should be neat and easy to understand.</td>
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6. Guidelines for Final Project

The final project can be done individually or in groups (It would be best to use the same groups that you are using for class assignments. However this is not a requirement).

You can choose from two possible types for your final project (see sample outlines below):
1. “Case study”: Analyze an existing logistics process and suggest any improvements to be made (A case study could also represent opportunities for new business models), or
2. “White paper”: Study logistics practices in industry from the point of describing risks, benefits, best practices along with industry examples of each.

A one page project proposal is due October 17, 2019. The goal is to ensure that you have selected a project and can spend the remaining six weeks working on it. The project is due in the last class on December 5, 2019.

Based on your proposals, I will select three groups to present their projects in class. The objective of this selection is not to chose what I consider the "best" proposals but to ensure that a variety of supply chain situations get presented in class. The groups making presentations will not be required to write a detailed report. They can submit their presentation materials for grading. Each group will have 20-25 minutes to make their presentation. All other groups will be required to submit a project report.

Analyze an existing logistics process and suggest improvement
Examples include
- A study of the distribution system and store deliveries at McDonalds
- The design of a logistics system for a manufacturer of refrigeration equipment
- A study of inventory practices at a company with suggestions for improvement.

The project report should not be a detailed description of everything you have done but a specific set of observations and recommendations. The general guidelines for the project are as follows:

1. Include an executive summary no longer than 250 words.
2. Define the process and the context (business unit) in which it operates.
3. What is the strategy / market of the business unit?
4. What does this imply in terms of the supply chain process you are studying? You are expected to identify specific dimensions along which the process is expected to do particularly well.
5. Describe the current process structure in terms of information, inventory, transportation, facilities, sourcing and pricing.
6. Discuss the current process capabilities/weaknesses in terms of the specific dimensions identified by you in 4 and 5. What additional capabilities does the process need to develop?
7. How should the process be restructured to develop these capabilities? Discuss why the changes suggested by you will have the desired effect along the key dimensions identified by you.
8. Discuss how the suggested changes should be implemented with a time line. Explain any resistance you may face in implementing the changes.

Please note that these are general guidelines. I am not looking for a project report with nine points in the sequence listed above. I have listed the points that I feel are important in most reports. Please feel free to add to or alter the above list as best fits your project.

Study logistics practices in industry
The objective here is to study logistics practices in industry such as

- Impact of sustainability on supply chains
- Off-shoring, near-shoring, and on-shoring
- Supply chain issues in a specific industry: PC, Retailing, Automotive etc.

Please do not restrict yourself to the above list. It is just meant for illustration.

In each report I expect:

1. An executive summary no longer than 250 words.
2. A description of the logistical practice including its key elements and its role in the overall supply chain. Link the practice to supply chain drivers.
3. Major risks/cost and benefits of the practice.
4. Key issues in designing and implementing the practice.
5. Which companies is this practice ideally suited for? Which companies may it not be suitable for?
6. Examples of companies that are successfully using the practice including best practices.
7. Examples of companies that have been unsuccessful in their implementation of the practice and possible reasons.

Once again, please do not feel bound by the above structure. It is simply meant to help you get started. If you are writing on the issues in a specific industry, identify the supply chain issues that offer a key competitive advantage in the industry and discuss examples of where they have been successfully or unsuccessfully implemented. The idea is to write a white paper that an industry participant can read to get ideas for improvement.

Grading:

As per the honor code, an individual should include his/her name on the final project only if they have contributed to the analysis. I will collect peer evaluations for the final project at the end of the term and use them for grades.

- Your grade will be determined based on the quality of your report or presentation.
- Some characteristics that I use to evaluate the quality of a report / presentation are as follows:
  - Sound structure, based on a relevant conceptual framework.
  - Comprehensive coverage of the relevant issues.
  - Consistency and depth of analysis; specific rather than vague.
  - Good balance and links between description, analysis and recommendations.
  - When you draw on other sources, it is important that you not merely 'cut and paste' them into your text, but carefully integrate the underlying reasoning into your analysis.
  - Clearly written / well organized.
Final Project: Deadlines & Deliverables
- Proposals due: Class 8 (October 17).
- Reports or presentations due: Class 20 (December 5). Late submissions are not acceptable.

Report: Length and Format
- Around 8-12 pages, double-spaced, excluding title page, executive summary, table of contents, and exhibits. Include a table of contents with references to numbered pages. In general, use the minimum space required to make the points you desire.
- All details are to be put in an appendix in the form of exhibits, tables etc.
- Make explicit reference to your sources, in footnotes or endnotes, and list them in an exhibit.

Presentation: Length and Format
- 20-25 minutes, including Q&A, per group.
- Please use (PowerPoint) slides. Have your presentation also ready on a memory stick.
- Make sure that your slide set is a coherent document that clearly conveys the main points in each part of your analysis.
- I leave it up to you to determine how many group members deliver the presentation.

Report and Presentation: Submission Guidelines
- Upload electronic file at the beginning of the last class session.