## DRAFT COURSE OUTLINE: FALL 2018 – SECTION 61

**PROFESSOR CHOPRA**

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| 1       | Module 1: Designing an Operations Strategy  
Introduction to Processes & Operations | **The Goal:** Finish (up to p. 246)  
MBPF, Chapter 1 |  |
| 2       | Aligning Strategy and Operations. Focus | MBPF, Chapter 2  
Case: Shouldice Hospital Limited  
Case: Wriston Manufacturing | Wriston Manufacturing |
| 3       | Product-Process Matrix  
Module 2: Measuring and Improving Process Performance  
Process Performance Measures and Little’s Law | MBPF, Chapter 3 |  |
| 4       | Process Flow Analysis. Targeting Improvement | MBPF, Chapter 4  
Case: CRU Computer Rental | CRU Computer Rental |
| 5       | Flow Time & Capacity Analysis | MBPF, Chapter 5  
Case: Body Scans and Bottlenecks |  |
| 6       | Flow Time & Capacity Analysis | Case: Weight Solutions Clinic – Bariatric Surgery Center | Weight Solutions Clinic –  
Bariatric Surgery Center |
| 7       | Module 3: Designing Lean Operations  
House Building Game |  |  |
| 8       | Paradigm of Lean Operations | MBPF, Chapter 10: Sections 10.1–10.4 |  |
| 9       | Lean Operations for Variety & Continuous Improvement | Excel exercise: The Dice Game |  |
| Review 1 | Optional Review instead of office hours. Check web for room | Review Sessions 1–9 |  |
| 10      | Midterm Exam: in-class, closed-book |  |  |

* There are optional readings not listed here. See detailed syllabus.
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Course Description and Objectives

Business processes are at the core of every organization and are critical to the success or failure of every business. Business processes touch the flow of information, product and funds within a firm and include the design of a product or service, its production, sale and distribution as well as the management of accounts receivables. Essentially every activity in the organization should be part of a value creating business process. The Chief Operating officer (COO) of an organization is in charge of all business processes. Well designed and managed business processes have allowed organizations like Wal-Mart, IKEA, and Aravind Eye Hospital (in India) to be successful. Challenges in the design of their business processes have resulted in firms like Borders and Blockbuster declaring bankruptcy.

This course aims to develop both process thinking and design thinking (as applied to the design of business processes) and focuses on three questions:

1. What is a “good” business process?
2. Where to target improvement efforts?
3. How to improve business processes?

The first question can only be addressed in the context of the strategy of the firm and the needs of the customer segment(s) being served. The course develops a strategic framework to address this question. Answering the second question requires the identification of key operational and financial metrics and linkages between the two. We identify time, inventory, throughput, cost
and quality as the fundamental operational metrics. The last part of the course focuses on developing design and management principles that help improve performance of business processes along each of the five metrics.

**Required Texts**

Required materials available at the bookstore:

1. Course Pack: cases.

All cases listed in the class-by-class reading list below are found in Course Pack. Readings listed as “optional” can be found in the Course Documents section of the class Canvas site.

As a novel, *The Goal* is light reading and some sections are quite entertaining. Nevertheless, it has 337 pages, so you are encouraged to start reading now. Please try and finish until page 255 before the start of the quarter. We will draw on it during the entire course. You will be asked to hand in your main take always near the end of the course.

**Grading**

The grade you receive for the course is intended to certify your demonstrated proficiency in the course material. Proficiency will be estimated by measuring your performance on (1) written team assignments and (2) exams. The midterm exam will be in class, closed-book, and will be held during regular class session 10. The final will be a three-hour, in-class exam with open readings, open class handouts and notes. It will be comprehensive, covering material from all course modules. While there is no explicit grade for class participation, class interaction is key to a successful course. I encourage all of you to participate and will cold call as well to encourage and ensure every one’s input.

Your course grade will be based on a weighted evaluation of the following categories:

1. Case write-ups 20%
2. Midterm examination 25%
3. Quizzes 5%
4. Comprehensive final examination 50%
Preparing for Class

Course assignments are designed to engage you in the issues, to teach you ways to think about and analyze operational problems, and to prepare you to be effective managers. The enclosed course outline and detailed schedule provides you, class by class, with a brief description of the class, the readings and case preparation questions (if any).

As part of your class preparation, please consider how you would answer each of the discussion questions. The readings and assignments should require an average of about three to four hours of preparation per class meeting. If you find yourself averaging more preparation time per session, please let me know. (Typically, students find the class load high in the first few weeks. As you become more comfortable with the material, this subjective assessment will change for the better.)

Case Write-Ups

Each case write-up should address the questions that go with the case assignment. In preparing your write-up, please adhere to the following guidelines:

⇒ Be concise and well-structured: Recommendations should be summarized on the first page and be complemented by a crystal clear discussion of how these follow from your analysis.
⇒ Your write up should not exceed 2 pages of text (11pt, 1½ lines spaced), not including exhibits. (Remember: 2 pages is a limit, not a quota.)
⇒ Be to the point: Know that you write to someone who knows the facts of the case; focus on your explaining, and making a clear case for, your recommendations.
⇒ Be punctual: Late submissions will not be accepted.

All case write-ups are to be done in assigned groups. Group assignments will be available by the first class. For most cases, 3 to 4 hours of team-time (after personal prep) should be sufficient. Cases before the midterm are likely to take longer than assignments after the midterm. Some cases are detailed and more open-ended. You should use your team’s judgment to figure out how to tackle those cases. The goal of the team approach to case prep is to have you think and experiment while sensitizing you to those issues that are novel and that will be further discussed in class.

The Kellogg Honor Code stipulates that you may put your name on the submission only if you contributed to the group discussion. Toward the end of the term, you will be asked to fill out an assessment of teammates’ contributions to group assignments. These assessments will play a role in determining final grades.

The Kellogg Honor Code also stipulates that you may not use any outside materials in preparing the case write ups. This includes (but is not limited to) handouts from past terms and materials found on the Internet.
Class Contribution

In-class contribution will consist mainly of voluntary contributions, although I will call upon students to encourage broader participation. (Although cold calling may increase anxiety, I feel that “supportive” cold calling encourages you to be better prepared for class and as a result improves the overall class discussion and learning.)

Laptops and Cell Phones

You may use your laptop for the purposes of taking notes but please sit in the back row. I reserve the right to ban laptops if their use becomes a distraction. I am very firm on the use of cell phones – please turn your cell phones off before entering class.

Use of the Web

Canvas will be used to facilitate course progression through announcements and a discussion group.

You are also encouraged to check out Kellogg’s operations management blog, The Operations Room: http://operationsroom.wordpress.com/ as well as Operations related faculty research articles on Kellogg Insight available at http://insight.kellogg.northwestern.edu/
Suggested Readings

None of these readings are a requirement for the course. Nonetheless, you may find them interesting.


Module 1: Designing an Effective Operations Strategy

Class 1: Introduction to Processes and Operations

Objective: Characterize processes and operations and their link to business strategy to gain competitive advantage.

Required Reading: Finish reading the first 246 pages of *The Goal* before you come to the first class. *MBPF, Chapter 1* can be read after Class 1.

Preparation Questions:
1. In a business context, what is meant by a process and operations?
2. What are the competitive priorities of a typical (service or manufacturing) business?
3. What role do processes and operations management play in achieving these goals?

Class 2: Aligning Strategy and Operations.

Objective: Illustrate the importance of aligning strategy and operations through the appropriate design of processes. Discuss the notion of strategic focus and operational focus in process design.

Required Reading: *MBPF, Chapter 2*.

Case: *Shouldice Hospital*. Be prepared to discuss the following questions:
1. What are inputs, outputs, and resources at Shouldice hospital?
2. What are Shouldice’s competitive priorities? What kind of market have they chosen to focus on? How does their operations strategy support their business strategy?

Written Assignment: *Wriston Corporation: The Detroit Plant*. Address the following questions in your writeup.

1. Why do overhead costs (Exhibit 2) vary so greatly from plant to plant in Wriston’s manufacturing network?
2. What would you recommend be done with the Detroit facility? Why?
Module 2: Measuring and Improving Process Performance

Class 3: Product-Process Matrix (Module 1). Process Performance Measures and Little’s Law

Objective: Discuss process types, their characteristics and the product-process matrix (this wraps up Module 1).
Link operations to the financials of a firm. Introduce the fundamental process performance measures throughput, inventory and flow time. Use Little’s Law to link the three measures. Discuss the cash conversion cycle.

Required Reading:  MBPF, Chapter 3.

Class 4: Process Flow Analysis. Targeting Improvement

Objective: Discuss where to target improvement using process flow charts and fundamental process performance measures such as flow time, inventory and throughput.

Required Reading:  MBPF, Chapter 4.

Written Assignment: CRU Computer Rentals. We will discuss the questions listed at the end of the case in class. Address all of the following questions in your write-up:

1. What is the process at CRU? Make a flow chart clearly identifying activities, routes and any other data given in the case.
2. What do you think about the decision to launch a sales drive this year?
3. What actions would you suggest Richard focus on to improve performance at CRU? Make concrete recommendations and indicate anticipated benefits.
4. What are the key performance measures Richard should focus on?

Note: your qualitative discussion should be backed by quantitative analysis.

Class 5: Flow Time & Capacity Analysis

Objective: Discuss the drivers of flow time and capacity. Understand critical paths and bottlenecks.

Required Reading:  MBPF, Chapter 5.

Case: Body Scans and Bottlenecks. Prepare the case with the following questions in mind:
1. Hospital management believed the new scanners represented a high-return investment. What factors would you take into account when calculating the difference in revenues represented by the new scanners versus the original units?

2. If the original process flows remained in place after the new CT scanners were installed, what level of scanning throughput could the hospital achieve? What hourly margins would result from using the new scanners with all other processes unchanged? How do these margins compare with using the old scanners? Use data from Exhibit 5.

3. What specific improvements might be made to improve the efficiency of the CT process flows? How would these improvements affect the margins?

4. How many hours a day would the new scanners have to operate to handle 92,000 patients per year? Assume that scanners are operated for 300 days in a year. How does increasing the number of hours worked per day affect the economics of the process?

5. If the technology of CT scanners continues to improve, how will process economics impact their purchase and utilization in hospitals and the health care system overall?

Class 6: Flow Time & Capacity Analysis

Objective: Reinforce and extend the concepts discussed in Classes 3-5 to settings with more complex flows and show how to apply them to guide capacity investment decisions.

Written Assignment: Weight Solutions Clinic. This is a challenging case. Please allocate sufficient amount of time (which will be made up for next week). Address the following questions in your write-up:

1. Draw the process flow map for a patient who undergoes bariatric surgery. Include the patient’s entire experience.

2. If all patients select laparoscopic surgery and pay by insurance, how many patients can the Center handle per week? If all patients opt for laparoscopic surgery and pay cash, how many patients can be processed? What if half the patients opt to pay by insurance and half with cash? Identify the bottleneck resource for each case.

3. What actions can help the clinic increase its capacity?

Recommended problems: 4.1, 4.2, 4.4, 4.6 (flow time); 5.1, 5.2, 5.4 (capacity).
Module 3: Improvement Paradigm I - Designing Lean Operations

Class 7: House Building Game

Objective: Explore the relationship between the design of a process and performance (inventory, time, throughput, cost, and quality) through a team-based game.

Class 8: Paradigm of Lean Operations

Objective: Introduce the improvement paradigm of lean operations (drawing on your house game experience) to identify lean tools and principles that help reduce waste along all operational metrics.

Required Reading: MBPF, Chapter 10: Sections 10.1 – 10.4.

Class 9: Designing Lean Operations for Product Variety and Continuous Improvement

Objective: Study the major components of the Toyota Production System and critically assess the costs and benefits. Discuss how a capping of buffers can be used to increase visibility of performance to drive continuous improvement.

Interactive exercise: The Dice Game from The Goal, available in two versions. Point your browser to:

www.kellogg.northwestern.edu/faculty/chopra/ftp/omd30/leanoperations/dicegame/pageone.htm

Class 10: Midterm Exam

In preparing for the midterm, I suggest that you review the sample midterm (available on Canvas) and MBPF examples and exercises (solutions are available on Canvas).

The midterm exam will be in class during our regular class session. The following instructions and Honor Code restrictions apply to this exam.

1. You will have 90 minutes to do this exam.

2. You must do this exam completely by yourself. This includes not discussing the exam with anybody else before or after you take it until the papers are returned.

3. This is a closed-notes/closed-book. The only materials you may have out during the exam are scratch paper and your laptop to be used only as a calculator.
Module 4: Improvement Paradigm II - Measuring and Controlling Process Performance

Class 11: Process Performance Measurement and Evaluation

Objective: The first step in performance evaluation is to map “the voice of the customer” into performance specifications for the product or process. The second step is to determine the current process capability and plans for improvement. Once the plans are implemented, a manager needs to “check” that improvement has actually taken place. Finally, a manager needs mechanisms to verify that the process continues to provide improved performance. In this context we introduce statistical process control.

Required Reading: MBPF, Chapter 9

Case: Quality Wireless (A), (B). Prepare the questions attached to the cases. There is no assignment due.

Class 12: The Value of 6-Sigma

Objective: Discuss the benefits from continuous process improvement.

Case: 6-Sigma Quality at Flyrock Tires. Prepare the questions attached to case. There is no assignment due.

Module 5: Designing and Managing Processes with Queues

Class 13: Capacity, Queuing & Flow Time Analysis

Objective: Introduce queuing phenomena and discuss managerial actions that mitigate negative impact of queues on operational performance.

Required Reading: MBPF: Chapter 8.

Recommended problems: 8.1, 8.4, 8.5, 8.8.

Written Assignment: Quality Management Problem Set (As always, this is a group assignment!).

The problem set is available through Canvas.

Class 14: Design of service systems (Pooling vs. Segregation, Specialization vs. Flexibility, Limited buffers, Priorities)

Objective: Show how concepts of service design (based on queuing theory) can be used as a tool for designing and managing service operations facing time-sensitive customers.

We use the Excel workbook Queue.xls to analyze various examples.
Class 15: Design of Service Systems

Objective: Illustrate how queuing theory can be used as a tool for designing and managing service operations.

Written Assignment: The BAT Case.

Question 1 is intended to help you understand whether providing better service to all customers is feasible and how this would change if BOP! Team 1 saw either a higher or lower volume of calls. The remaining questions aim at evaluating the Fast Track proposal. The write-up should address Question 7.

1) Given the current arrival rate, what would it take to offer a one minute average wait for all customers? What is the utilization of the system? How would these values change if the arrival rate increased or decreased by 25%?

2) Suppose Grayson implements Fast Track by keeping BOP! Team 1 together as one team and giving priority to Fast Track calls. What staffing levels are needed to deliver a one-minute Fast Track wait for the demand rates that the consultants have forecasted? If additional technicians are needed, is Fast Track economically viable?

3) Is promising a one-minute wait sufficient or should they have service be free when the wait exceeds one minute? Is the program viable if BAT provides free service to all Fast Track callers who have a wait over one minute?

4) What is the impact of Fast Track on standard calls? Holding the staffing level constant how does the difference in the waiting time of standard and Fast Track calls change as the arrival rate falls to 20 calls per hour or rises to 25 calls per hour?

5) How should BAT implement Fast Track? Should BOP! Team 1 be kept as one team or should it be split into separate subteams, dedicated to either Fast Track or standard calls? (Assume that the standard call subteam has to be big enough to keep the average wait below current levels.)

6) Should BAT offer service contracts or just pay-per-call service?

7) What is the economic return on implementing Fast Track? Would you implement Fast Track? Clearly explain why or why not.

You may want to use the Excel workbook Queue.xls to analyze this case. It is available from Canvas.
Module 6: Supply Chain Management

Class 15: Inventory Basics.

Objective: Introduce the role of inventory in supply chains.

Class 16: Economies of Scale & Cycle Inventory. Uncertainty and Safety inventory

Objective: Discuss how to manage cycle inventories to exploit economies of scale. Discuss forecasting characteristics and how to manage safety inventory to protect against uncertainty in demand and/or supply lead times.

Required Reading: MBPF, Chapter 6, 7.

Case: Palü Gear. Questions 1.a to 1.d. There is no assignment due.

Recommended problems: 6.2, 6.4, 6.5, 6.10, 7.1, 7.2.

Class 17: Safety inventory and Optimal Service Level.

Objective: Finish discussion of safety inventory. Discuss the “newsvendor” model, a simple but important methodology for determining the optimal order quantity and level of product availability, in the context of short-life cycle products, e.g., fashion goods, whose value quickly decay over time.

Required Reading: MBPF, Chapter 7: Section 7.3

Recommended problems: 7.4, 7.5.

Class 18: Service Levels, Safety Inventory & Pooling

Objective: Finish newsvendor discussion. Discuss the concept of inventory “pooling” and its role in supply chain design.

Required Reading: MBPF, Chapter 7 (skip Section 7.4.2)

Case: Palü Gear. Questions 1.c & 1.d. There is no assignment due.

Recommended problems: 7.3, 7.8, 7.9.
Class 19: Pooling: Centralization & Postponement

Objective: Discuss different pooling methods, particularly centralization and postponement, their pros and cons, and implications for supply chain design.

Required Reading:  *MBPF, Chapter 7: review Sections 7.5-7.6*

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<th>Written Assignment: Movie Rental Business. Address the following questions in your writeup:</th>
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<td>1. What are the key success factors in the movie rental business? How do Redbox, Blockbuster and Netflix compare on those dimensions?</td>
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<td>2. For each company, identify how the supply chain structure impacts the various financial metrics reported in their financial statements.</td>
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Class 20: Wrap Up and Review

No readings.

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Final Exam

The time and room for the final exam will be announced as soon as it is finalized with the registrar. In preparing for the final, I suggest that you review the sample final (available on Canvas) and MBPF examples and exercises (solutions are available on Canvas).

This exam will be open readings, open class handouts and open class notes. You may use the computer worksheets used in class. The following instructions and Honor Code restrictions apply to this exam.

1. You will have 180 minutes (three hours) to do this exam.
2. You must do this exam completely by yourself. This includes not discussing the exam with anybody else until all students have taken the exam (assume the Monday after finals week).
3. You may consult your textbook, class handouts and class notes. You may not use any other materials. You may use a calculator and/or laptop computer. A laptop may be used for a calculator or Excel only.