

## **COURSE: Operations Management Analytics: Dealing with Operational Complexity**

**Dates : September 11 to October 1**

**Professor:** Luis López

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TA:

Course website:

Pre-requisite: None

### **Course Description**

This course is a study of how different strategic operational configurations work. The students in the course will develop the analytical skills necessary to evaluate and understand complex process behaviors and to make performance-improving decisions. Course participants will manage a simulated company that operates in a complex and data-rich environment. The students receive the company in a precarious situation, and they must plan and implement strategies to resuscitate the firm and achieve corporate objectives.

Throughout the course students will gain familiarity with key concepts in the field of operations management and will come to understand, by managing a complex operation, the interactions that take place between the operational side of a business and other functional areas of the firm, such as finance and human resource management. More importantly, the students will have to manage a complex operation in a highly engaged manner by developing and implementing strategies in association with teammates who are likely to be operating in distant places, other time zones, and within different contexts. To do so, the students must develop organizational structures and coordinating mechanisms for making timely decisions in an efficient manner over protracted periods. As teams see their performance develop alongside that of other student groups, a rich learning environment will ensue in which participants will learn concepts and execute strategies on strict timelines and under pressure.

### **Course Objectives**

At the end of this course, the student will have a good understanding of the fundamental concepts of operations management. The student will understand that business processes require distinct configurations in order to attain different competitive objectives and to satisfy diverse customer needs.

- 1) Understand that business processes require distinct configurations in order to attain different competitive objectives and to satisfy diverse customer needs.
- 2) Have a good understanding of process characteristics, and will understand that such notions are applicable to all productive realms and not just to the manufacturing one.
- 3) Develop a systemic view of the business.
- 4) Have a good understanding of how all firm functional areas can interact to achieve desired managerial objectives.
- 5) Use data extensively to support decision-making processes.
- 6) Be able to analyze a process and determine the constraints that limit process output.
- 7) Acquire abilities and knowledge in the following areas:

## PRELIMINARY SYLLABUS

- a. Long term capacity planning
  - b. Continuous-review inventory management systems.
  - c. The effects of variability upon production processes.
  - d. Dealings with shared resources and batching.
  - e. The effect that setups have upon planning an operation.
  - f. Different metrics used to measure process performance, such as utilization, processing time, resource capacity, throughput, throughput time, and work in process inventory.
- 8) Understand that managing a firm requires the development of mechanisms to coordinate and streamline the decision-making process.

### Course work

#### **General Organization**

The course has three segments. In the first block, we will review basic operation management concepts. This review ensures that students have the necessary skills to understand and be able to manage the learning laboratory we will use in the second portion of the course. In this second block, the student will manage a hypothetical company over a period of approximately 10 days. During this period there will be a few short lectures related to issues taking place in the simulation (such as, for instance, the effects of variability, or inventory management). In the last portion, we will assess the results and reflect upon the lessons learned.

#### **Methodology**

The methodological elements that comprise the course are:

Case studies and readings: Case studies provide an opportunity to understand and apply concepts in the context of real situations.

Plenary sessions: Class meetings to discuss the assigned cases and important notions in the readings.

Lectures: Topic-specific short lectures.

Learning Laboratory (simulation): Students will have to make decisions over time in a simulated complex environment. There will also be one additional minor simulation very specific to certain topic.

Discussion board: The discussion board is an important vehicle for contributing to the class, by posting interesting and substantive questions, comments or answers.

#### **Grading.**

Three Short case or exercise write-ups (individual 1-page): 24%

Performance during simulation (team, based on cash on hand attained): 16%

Simulation Report (team, 3 page + exhibits): 40%

Class participation (plenaries and discussion board): 20%

Students are encouraged to participate in class and to post on the discussion board regularly

**Course material:**

Students will get logins and passwords to access the course website before the beginning of the course. All necessary reading material will be on the site at no cost.

Each student needs to purchase one simulation software license. The cost of this license is US\$25 – twenty five US dollars.

**Workload**

We have designed the course so that students will need to dedicate about one hour and a half per day to it, on average. This is in line with expected work at the graduate level, which usually requires upwards of 10 hours per week per course. For a large portion of the course, students will be working in teams.

There are five synchronous sessions in this course, which will be at the following dates and times:

**NOTE: The times are for Costa Rica, which is *GMT -06:00***

**Plenary Session #1:**

*Tuesday, September 12<sup>th</sup>, at 9:00 am*

*(This is the time at origin, which is in Costa Rica, **GMT -06:00**)*

**Plenary Session 2**

*Thursday, September 14<sup>th</sup>, at 2:00 pm (14:00)*

*(This is the time at origin, which is in Costa Rica, **GMT -06:00**)*

**Plenary Session 3**

*Monday, September 18<sup>th</sup>, at 2:00 pm (14:00)*

*(This is the time at origin, which is in Costa Rica, **GMT -06:00**)*

**Plenary Session 4**

*Wednesday, September 20<sup>th</sup>, at 2:00 pm (14:00)*

*(This is the time at origin, which is in Costa Rica, **GMT -06:00**)*

**Plenary Session 5**

*Friday, September 29<sup>th</sup>, at 2:00 pm (14:00)*

*(This is the time at origin, which is in Costa Rica, **GMT -06:00**)*

The following table provide an idea of the course's progression:

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| Week                     | Class  | Individual Study (minutes) | Working on Simulation in teams (minutes) | Discussion forum (minutes) | Weekly estimated Time (minutes) |
|--------------------------|--|----------------------------|--|----------------------------|---------------------------------|
| 1                        | 1-Introduction to process analysis<br>Exercises and short introductory lecture<br>Reading: Process Fundamentals<br>Class time: 100 minutes   | 160 minutes                | 0 minutes                                | 25 minutes                 | 365                             |
|                          | 2-Process analysis<br>Case: National Cranberry Cooperative<br>Reading:<br>Class time 80 minutes  |                            |  |                            |                                 |
| 2<br>(Simulation begins) | 3-Operations Strategy and execution<br>Case: Medica Scientific<br>Reading:<br>80 Minutes   | 140 minutes                | 150 minutes                              | 45 minutes                 | 515                             |
|                          | 4- Managing complex operations<br>Reading: Medica Scientific simulation, instruction manual<br>Lecture: explaining the simulation, meeting the team, planning the strategy<br>80 minutes |                            |  |                            |                                 |
|                          | 5-Aggregate Capacity Planning<br>Short Lecture (Asynchronous)<br>20 minutes  |                            |  |                            |                                 |
| 3                        | 6- Inventory Management<br>Short Lecture<br>20 minutes (Asynchronous)  |                            | 300 minutes                              | 50 minutes                 | 470                             |
|                          | 7- Variability and its effect on process performance<br>Short Lecture<br>20 minutes (Asynchronous)   |                            |  |                            |                                 |
|                          | 8-Lecture: Course Wrap and Student presentations<br>80 minutes   |                            |  |                            |                                 |
| TIME TOTALS              | 480  | 300                        | 450                                      | 120                        | <b>1350</b>                     |

PRELIMINARY SYLLABUS

Detailed schedule

|                            | 9/11   | 9/12       | 9/13      | 9/14      | 9/15     | 9/16     | 9/17      | 9/18      | 9/19      | 9/20      | 9/21     | 9/22      | 9/23      | 9/24      | 9/25      | 9/26      | 9/27      | 9/28      | 9/29       | 9/30      | 10/1 |             |
|----------------------------|--|------------|-----------|-----------|----------|----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|------|-------------|
| WEEK                       | 1  |            |           |           |          |          |           | 2         |           |           |          |           |           |           | 3         |           |           |           |            |           |      |             |
| DAY                        | M  | T          | W         | TH        | F        | S        | SU        | M         | T         | W         | TH       | F         | S         | SU        | M         | T         | W         | TH        | F          | S         | SU   |             |
|                            | 1  | 2          | 3         | 4         | 5        | 6        | 7         | 8         | 9         | 10        | 11       | 12        | 13        | 14        | 15        | 16        | 17        | 18        | 19         | 20        | 21   |             |
| <b>Activity</b>            |  |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| Plenary                    |  | P1         |           | P2        |          |          |           | P3        |           | P4        |          |           |           |           |           |           |           |           |            | P5        |      |             |
| Individual study           | X  |            | X         |           |          |          | X         |           | X         |           |          |           |           |           |           |           |           |           |            |           |      |             |
| Team work                  |  |            |           |           |          |          |           |           |           |           |          | X         | X         | X         | X         | X         | X         | X         | X          | X         | X    |             |
| Asynchronous Lecture       |  |            |           |           |          |          |           |           |           |           |          |           |           | X         | X         | X         |           |           |            |           |      |             |
| Simulation running         |  |            |           |           |          |          |           |           |           |           | X        | X         | X         | X         | X         | X         | X         | X         |            |           |      |             |
| Forum                      | X  | X          | X         | X         | X        | X        |           | X         | X         | X         | X        | X         | X         | X         | X         | X         | X         | X         | X          | X         | X    |             |
| <b>Time required (min)</b> |  |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| Plenary                    |  | 100        |           | 80        |          |          |           | 80        |           | 80        |          |           |           |           |           |           |           |           |            | 80        |      |             |
| Individual study           | 80   |            | 80        |           |          |          | 80        |           | 60        |           |          |           |           |           |           |           |           |           |            |           |      |             |
| Team work                  |  |            |           |           |          |          |           |           |           |           |          | 50        | 50        | 50        | 50        | 50        | 50        | 50        | 50         | 50        | 50   |             |
| Asynchronous Lecture       |  |            |           |           |          |          |           |           |           |           |          |           |           | 20        | 20        | 20        |           |           |            |           |      |             |
| Forum                      | 5  | 5          | 5         | 5         | 5        |          |           | 5         | 5         | 5         | 5        | 5         | 10        | 10        | 10        | 10        | 10        | 10        | 10         |           |      |             |
| <b>TOTAL TIME</b>          | <b>85</b>  | <b>105</b> | <b>85</b> | <b>85</b> | <b>5</b> | <b>0</b> | <b>80</b> | <b>85</b> | <b>65</b> | <b>85</b> | <b>5</b> | <b>55</b> | <b>60</b> | <b>80</b> | <b>80</b> | <b>80</b> | <b>60</b> | <b>60</b> | <b>140</b> | <b>50</b> |      |             |
|                            |  |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      | <b>SUM=</b> |
|                            |  |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      | <b>1350</b> |
|                            |  |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      | <b>MIN</b>  |
| <b>Deliverables</b>        |  | C          |           | C         |          |          |           | C         |           |           |          |           |           |           |           |           |           |           |            |           | R    |             |
| P1                         | PLENARY 1: SKILL EXERCISES. WRITE-UP DUE                   |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| P2                         | PLENARY 2; CASE:NCC, CASE WRITE-UP DUE                     |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| P3                         | PLENARY 3: CASE: MEDICA-SCIENTIFIC, WRITE-UP DUE           |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| P4                         | PLENARY, INSTRUCTIONS FOR SIMULATION                       |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| P5                         | WRAP-UP  |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| C                          | SHORT INDIVIDUAL WRITE-UP                                  |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |
| R                          | TEAM REPORT: LESSONS LEARNED, MEDICA SCIENTIFIC SIMULATION |            |           |           |          |          |           |           |           |           |          |           |           |           |           |           |           |           |            |           |      |             |

**Course Materials**

| <b>Week 1</b>   |
|---|
| <p><b>Plenary Session #1:</b><br/><i>Tuesday, September 12<sup>th</sup>, at 9:00 am</i><br/><i>(this is the time at origin, which is in Costa Rica, GMT -06:00)</i></p> <p>Introduction/review of process design and analysis<br/>Process fundamentals, process analysis, and process design.</p> <p>Topics to be learned:<br/>Process diagramming, bottleneck, resource utilization, Throughput, Inventory, Throughput time, cycle time, Little's Law, Bottleneck, Labor utilization, Inventory and inventory turns, Make to stock, make to order, variability, the effects of variability.</p> <p>Exercises: Operations Management skill exercises<br/>Reading: Process Fundamentals</p> <p>In these two sessions, we will become familiar with some basic terminology. We will learn basic concepts like Process diagramming, resource utilization, throughput, Inventory, throughput time, cycle time, Little's Law, bottleneck, labor utilization, Inventory, inventory turns, make to stock, make to order, variability, and the effects of variability.</p> <p>The note "Process Fundamentals" provides a good overview of process related topics. Please read the note carefully. Some concepts might be difficult at first, but they will become clear as we go along. After you read the note, please do the "Production and Operations Management Skills Exercises."</p> <p>Write-up due</p> |
| <p><b>Plenary Session 2</b><br/><i>Thursday, September 14<sup>th</sup>, at 2:00 pm (14:00)</i><br/><i>(this is the time at origin, which is in Costa Rica, GMT -06:00)</i></p> <p>Process analysis and design in action<br/>Case: National Cranberry Cooperative (Abridged). (HBS- 688122)</p> <p>National Cranberry Cooperative (NCC) is a grower-oriented agricultural cooperative that processes and markets cranberries. The case describes the concerns of the VP-Operations about NCC's receiving plant #1. This plant receives harvested berries, which it cleans, grades, and sorts in preparation for packaging or further processing. RPI is open for operation about four months a year. During the processing season, in the year prior to the time of the case, the plant incurred high overtime costs. In addition, the grower-owners of the coop were frequently forced to wait long hours to unload their trucks. Several alternative solutions to these problems are mentioned in the case, and additional alternatives can be formulated and evaluated. Questions:</p>  |

1. What are the most critical problems facing National Cranberry that Mr. Schaeffer must address?
2. What is your analysis of the process fruit operation of receiving plant #1? First, do your analysis looking at a day with an arrival of 18,000 barrels of berries, of which 70% are wet. Assume trucks arrive evenly spaced throughout an 11-hour day starting at 7:00 a.m., and that processing operations (that is receiving, dechaffing, milling, etc.) also start at 7:00 a.m.
3. What recommendations, both short and long-term, would you make to Mr. Schaeffer?

Write-up due

**Week 2**

**Plenary Session 3**

*Monday, September 18<sup>th</sup>, at 2:00 pm (14:00)*

*(this is the time at origin, which is in Costa Rica, **GMT -06:00**)*

Operations Strategy and Long Term Capacity Planning

Case: Medica Scientific

Supplement: Medica Scientific Exhibits as an Excel file

It is the High Performance Team's first day in charge of Medica Scientific's MS-1 plant, a manufacturer of medical devices. The Board had just replaced the previous management team in its entirety. The new team's priority had been clearly stated by the Board: they had to revert a downward trend in available cash and to generate as much cash as possible before year's end. The team has started to the data for the last 50 days of operation. They are uncertain as to what actions are required to improve plant functioning.

*Assignment questions*

1-What is the problem facing Medica Scientific's MS-1 plant?

2-Examine Exhibits 1 and 3 of the case or the relevant information in the Excel supplement. What conclusions can you draw from these Exhibits?

3-Look at Exhibit 4 in the case and supplementary data and examine the characteristics of the plant. Look at both the custom and the standard lines. What differentiates the Custom Line from the Standard Line? Carefully note those differences.

4-How do you go about calculating process capacity? Estimate current capacity for both production lines.

5-How is raw material inventory managed?. How would you determine an appropriate reorder point and ordering quantity for raw material inventory management?

6-As part of the newly formed managerial team recently appointed by the Board, what do you recommend to improve MS-1 performance?

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Write-up due

**Plenary Session 4**

*Wednesday, September 20<sup>th</sup>, at 2:00 pm (14:00)*

*(this is the time at origin, which is in Costa Rica, GMT -06:00)*

Case Simulation: Medica Scientific; Operation Strategy and long term capacity planning

Reading: Medica Scientific simulation, instruction manual

Review: Medica Scientific (the case study)

In this session we will explain the simulation Medica Scientific

**Week 3**

Teams work on the Medica Scientific simulation, and students participate in discussion forum as needed.

Three short lectures (asynchronous).

Readings to be delivered as needed by the instructor.

**Plenary Session 5**

*Friday, September 29<sup>th</sup>, at 2:00 pm (14:00)*

*(this is the time at origin, which is in Costa Rica, GMT -06:00)*

Simulation Debrief and course wrap up.

No material assigned

Final Report Due