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**QUANTITATIVE MODELS IN
SUPPLY CHAIN MANAGEMENT
(35E00650)**

Instructor	Gyula Vastag https://scholar.google.com/citations?user=J2jwX-oAAAAJ&hl=en
E-mail:	gastag@gmail.com My university email address is vastag.gyula@uni-corvinus.hu but, for this course, please use email address given above.
Office hours:	There are no office hours, meetings are only by appointment. I will always be available for brief consultations before and after classes. Generally, email is the most efficient and preferred way to contact me and set up a personal meeting if needed.
Class:	Two sessions per day between 9:15 and 12:00 AM over six days: August 22 (Thu), 23 (Fri), 26 (Mon), 27 (Tue), 28 (Wed), and 29 (Thu). Exam will be on August 30 (Friday) between 9:00 and 10:30 AM.
Classroom:	R028/Q203 Q203 Ryhmäopetus

1. PREREQUISITIES

Knowledge of basic Statistics and elementary business skills are assumed. The course builds upon the Operations Management course you might have taken but Operations Management is not a prerequisite to this offering.

2. RECOMMENDED TEXTS, REQUIRED CASES, AND READINGS

Cachon, G., Terwiesch, C., 2013. *Matching Supply with Demand: An Introduction to Operations Management* (Third Edition). McGraw Hill: New York, NY. [This is a rigorous but highly entertaining text on Operations Management in a “manager-friendly” format.]

Hopp, W. J., 2008. *Supply Chain Science*. McGraw Hill/Irwin: New York, NY. [This thin book is perhaps the best concise summary of the theoretical underpinnings of Supply Chain Management.]

Goldratt, E. M., Cox, J., 1992. *The Goal—The Process of Ongoing Development* (Second edition). Great Barrington, MA: North River Press. [This is the greatest manufacturing novel ever; you cannot graduate with a business degree without reading it.]

Holweg, M., J. Davis, A. De Meyer, B. Lawson. R. W. Schmenner. *Process Theory (The Principles of Operations Management)*. Oxford, United Kingdom: Oxford University Press, 2018 [This new book by world-class scholars summarizes what everybody should know about processes and the core of Operations Management.]

Pound, E. S., J. H. Bell, M. L. Spearman. *Factory Physics for Managers (How Leaders Improve Performance in a Post-Lean Six Sigma World)*. McGraw Hill Education, USA, 2014 [This is the managerial version of the award-winning *Factory Physics* book by Spearman and Hopp].

Cases:

- Implementing Lean Operations at Ceasars Casinos (TB0389)
- L. L. Bean, Inc. (5-895-057)

Simulation program: The program (available for Win, Linux and Mac platforms) can be downloaded from <http://servitization.uni-nke.hu/>. The program documentation starts out in Hungarian but from Section 5 (page 65) the same information is repeated in English.

Comarow, A. 2003, July 28. Jessica's Story. *U.S. News and World Report*, Vol. 135, Issue 3, pp. 51-54. [To be distributed in class. This story describes how problems with the national organ transplant system killed a 17-year old girl. The girl was to receive a heart lung transplant and received organs that were against her blood type. The story describes how the entire chain from the initial screening to the inappropriate implantation failed to notice the discrepancies.]

3. COURSE DESCRIPTION

Managing the supply chain of an extended enterprise is a complex task that reaches across organizational boundaries, national borders and combines several functional areas. The objective of this course is to introduce and discuss basic principles and models of supply chain management in a practical, applied and dynamically changing setting. More specifically, the first half of the course covers some of the building blocks of supply chain management: process analysis, and lean manufacturing. The second half touches on inventory and supply chain management models and issues: the newsvendor model and its extensions, risk pooling, Vendor Managed Inventory (VMI), supply chain coordination and contracting.

In Hopp's (2008) definition: "*Supply chain is a goal-oriented network of processes and stock points used to deliver goods and services to the customers.*" Consequently, this course starts with an introduction to processes, process characteristics (inventory, flow time, flow rate) and Little's Law and focuses on concepts, laws, and models of supply chain management by which both supply chain processes and coordination among supply chain actors can be improved.

After an overview of the theoretical concepts, this course is about learning by "doing." We will use a simulation software to illustrate the complexities of managing interrelated and uncertain processes with capacity constraints. This software will be used throughout the course and for the group project. The group project is carried out in self-selected small groups. Considering that the project represents a significant portion of your grade, please choose wisely and early. Please note that I reserve the right to add/remove members from groups if I deem it necessary.

The objective of this course is to reinforce basic principles and explore why systems or supply chains behave the way they do. This course is about "understanding" supply chain management through highlighting the principles at work. The ultimate goal of the course is to convey replicable findings that may serve as basis for actionable managerial advice.

Upon successful completion of this course, you should gain a useful and thorough understanding of the concepts and models as they are used in various businesses to improve operations.

4. MAIN TOPICS

- Capacity
- Variability

- Batching
- Flows and Buffering
- Push/Pull systems
- Inventories in the supply chain: the newsvendor model and its extensions
- Vendor Managed Inventory (VMI)
- Risk Pooling
- Supply chain coordination and contracts

5. INTENDED LEARNING OUTCOMES

Core Learning Area	Learning Outcomes
Interpersonal Communication Skills	Presentations will help students hone their communication skills.
Cultural Sensitivity and Diversity	Considering the diversity of viewpoints by Aalto's diverse student body, it is expected that students will increase their cultural sensitivity and will develop greater tolerance toward opposing views.
Quantitative Reasoning	SCM is, to a certain degree, about the "arithmetics" of operations that will be reinforced and emphasized through examples and exercises.
Critical Thinking	The Socratic method of inquiry will help students question and clarify assumptions and develop actionable plans of suggestions.
Ethics and Social Responsibility	Briefly, we will cover the debated "triple bottom line" concept (financial, social/ethical, and environmental) and through the lenses of ISO certifications we will touch on issues of corporate social responsibility.
Management Knowledge and Skills	The course is aimed at providing models, concepts and methods of supply chain management for the general manager.

6. HOW THE CLASS SESSIONS WILL BE CONDUCTED

For me, the main purpose of education is to teach students to think effectively and to make them understand the theory behind surface events. I believe that as they interact with the course content, students should learn general intellectual skills, such as observing, classifying, analyzing, synthesizing, and conveying information in a logical, consistent manner. In this way, instruction is intended to help students gain intellectual autonomy and move beyond "pluginski" (plug in the numbers in the formula provided) and short-term memorization. Putting it in a different way, my goal is to convey generalizable findings that may lead to actionable managerial advice.

Some key assumptions I hold about education are that: 1) active learning is more effective than passive learning, 2) critical thinking skills are just as important as content acquisition, 3) demanding mental effort is painful in the short run but highly satisfying in the long run, 4) abilities and skills acquired in the classroom will transfer to the "real work world."

The instructional format will be a dialogue between the students and the instructor using the Socratic method of inquiry by asking a series of questions about the phenomenon under discussion. This approach assumes strong class participation that comes from good preparation. You are expected to attend all sessions, be prepared, contribute positively, regularly and

significantly to the class discussion and be courteous and professional to both your class mates and your instructor. In order to have a positive learning experience for everyone involved, please adhere to the following guidelines: turn off your cell phone before class, do not talk to your neighbors, or do not read anything other than the class material being discussed. Please be in the classroom on time and, if late, find your seat quickly and try to minimize your disturbance.

The quality of our discussions in large part depends on you and your preparation. We all benefit when as many people as possible put their minds to the task of preparing and sharing their views on the issue at hand. If I am judging you on your participation, what are the things I keep in mind: Are you in command of case facts? Do you understand the problem clearly? Have you explored the alternatives? Is your analysis persuasive (thoughtful, integrated, making use of data given)? How complete is the plan of action? "Air time" is not as important as analysis, numbers, and recommendations that are meaningful.

In closing, I would like to use a lighter tone for a moment to illustrate the learning process and the amount of work needed in this course. There is a saying in motorist circles that "there is no replacement for displacement" meaning that, using an example, even a technically sophisticated one-liter, three-cylinder engine cannot overcome the power and torque of a big-bore V-8. The same principle applies here; considering the complexity of the material and the cases, nothing can replace the amount of work needed. Theoretical insights and related work experience always help but the instruction material and the cases have to be read and analyzed several times, the simulations have to be run many times to get the insights needed. Please, make no mistake about it; this course is a "labor intensive" one. General guidelines call for 1-3 hours of preparation time for every classroom hour; please keep it in mind in scheduling your activities.

Course Feedback: If you have any comments or feedback about the course, please feel free to contact me any time. This is especially true about aspects of the course I can change on the "fly."

7. POLICY ON THE AVAILABILITY OF LECTURE NOTES

The PowerPoint slides, examples, notes, and graphs used in the class will be made available to you after class. Considering that PowerPoint slides are, in most instances, used as synonyms of lecture notes, I would like to point out that arguments against PowerPoint proliferation are well-documented. Please check out the following site: <http://www.edwardtufte.com/tufte/powerpoint>. For a devastating parody of PowerPoint, see Lincoln's Gettysburg Address in PowerPoint, by Peter Norvig at: <http://www.norvig.com/Gettysburg/index.htm>.

8. QUIZZES, EXAMS

There will be no quizzes in this course. At the end of the course, on August 30th (Friday), there will be a 90-minute exam reinforcing supply chain arithmetics. I will do my very best to post the results on or before Monday, the following week.

9. POLICY ON CLASS ATTENDANCE

Regular and punctual attendance at every class session is a requirement of all degree programs at Aalto University. Each class covers material not found in the readings. Furthermore, participation in class discussions is an important part of the learning experience for all students as well as a factor in grading. If illness or another unusual circumstance requires missing a class, please do your best to inform me in advance.

You can earn 10 points for attending six sessions, nine points for attending five sessions, and eight points for coming to four sessions. Attending three or fewer sessions will result in a failing grade.

10. CLASS PARTICIPATION

Your score is based on the quality and frequency of your contribution. High quality contributions will be graded more highly than attempts to monopolize "air time." Examples of high quality participation can include but are not restricted to the following: concise summary of the main points of the assigned readings, concise summary of a solution to a problem, taking a chance to propose a solution to a problem or question, contributing novel insights into the discussion, sharing personal/professional experiences related to the topic at hand, highlighting the relevance of current events to the discussion topic, advancing the discussion by building on the work of others. The scale I use is the following: 10=excellent, 9=very good, 8=good, 7=average, 6=fair; 0-5=I have no or very vague idea who you are and where you stand on issues discussed in class.

Participation Ground Rules

Participation in my classes has always gone smoothly and tends to be one of the highlights for the students. However, in an effort to provide a classroom environment as conducive to learning as possible, the following ground rules should be observed:

1. **Confidentiality.** Concepts and ideas can be taken from the class and discussed freely. However, personal stories or issues and/or professional situations raised by individuals are to be kept confidential and as the property of the class.
2. **Respectful Listening.** When differing with another participant's point of view, listen first before raising questions. When another participant raises a point we disagree with or find offensive, it is important to remember that the human being behind that question or comment deserves respect.
3. **Participation.** Participants who tend to be quieter are encouraged to contribute to enhancing the learning process by sharing their perspectives and experiences. Those who are aware they are prone to monopolizing discussions are encouraged to self-monitor their behavior and make room for quieter students.
4. **No Zaps.** In keeping with the notion of respectful listening, "putting-down" others in class is discouraged. "Zapping" another person often serves to discourage open and honest exchange of ideas among the whole group.

Last, please bring your name tent with you to every class and place it in front of you.

11. GRADING

There are two reasons for grading students; first it is a requirement. Other than having this regulation, grading serves essentially only one pedagogical function: students are much more likely to complete the readings and assignment questions if their work is graded. It has been proven that students, who prepare better, learn better.

Class Attendance (see Section 9)	10 points
Class Participation (see Section 10)	10 points
Case Write-Up and Presentation (group)	20 points
Simulation Exercise Write-Ups (group; 4 x 5 points)	20 points
Exam	40 points
Maximum total	100 points

Case Write-Up and Presentation (group assignment). Your self-selected small group will be asked to present the analysis of one of the cases in class. In evaluating your performance, I will rely on feedback from your classmates as well.

Simulation Exercise Write-Ups (group assignment). Your group will be given four assignments aimed at various aspects of process control. Each assignment is worth five points maximum.

The 90-minute **exam** is to reinforce the calculations we covered in class.

Grades will depend on your total point count relative to others in the course; the higher your percentile rank, the better grade you will get. However, as an instructor I have a moral, ethical and professional obligation to maintain and enhance the Aalto University brand and adhere to its high standards. Consequently, grades have to be earned by showing proficiency in and dedication to the studied material.

12. ACADEMIC INTEGRITY

Aalto University expects all students to adhere to the fundamental principles of academic integrity in any and all behaviors associated with their course work and otherwise. Attempted cheating of all forms is treated extremely seriously and can result in dismissal from the School and the University.

13. COURSE OUTLINE AND SESSION ASSIGNMENTS

The assignments should be cumulatively completed by the beginning of the session where they are listed.

TENTATIVE SCHEDULE (May Be Changed with Notice in Class; Case discussion questions to be distributed)	
SESSION	TOPICS, ASSIGNMENTS
1 Aug 22 (Thu) 9:15-10:30; 10:45-12:00	<p>Review of course content and requirements. Finalization of the participants, assignments, and deliverables. Introductions: process view of participants. Why are we here?</p> <p>Context and theory: the lecture will provide an understanding and illustrations of how contexts shape the message. The core argument is that contextual understanding is a necessary but not sufficient condition for providing actionable and replicable managerial advice. Managers also need guidance from theory to select, organize and act upon contextual information.</p>
2 Aug 23 (Fri) 9:15-10:30; 10:45-12:00	<p>Process foundations; Capacity, Process characteristics. Process analysis and Little's Law. Process exercises. Bottleneck analysis.</p> <p>Services, service supply chains, service blueprinting and process-chain-network. Managing variability and waiting time. Introducing the simulation software.</p>
3 Aug 26 (Mon) 9:15-10:30; 10:45-12:00	<p>Case: Implementing Lean Operations at Ceasars Casinos (TB0389).</p> <p>1. What are the most important elements of the process-improvement approach pursued at Tunica? What benefits were derived from this approach?</p> <p>2. Assume service scores for the area you manage, Harrah's Metropolis hotel housekeeping, have declined over the past year. As part of the LEAN rollout at Metropolis, you and some of your front-line employees will participate in a kaizen event focused on improving guest-room housekeeping operations. What KPIs (key performance indicators) would you propose to track to determine whether the changes implemented through the kaizen effort actually improve performance?</p> <p>3. Assume Hirsch has decided to follow a high-involvement approach similar to the one he led at Tunica. What challenges and risks do you anticipate Hirsch will face in moving forward at Metropolis, and how should he be prepared to respond?</p>
4 Aug 27 (Tue) 9:15-10:30; 10:45-12:00	<p>Simulation scenarios.</p> <p>The newsvendor model.</p>

TENTATIVE SCHEDULE (May Be Changed with Notice in Class; Case discussion questions to be distributed)	
SESSION	TOPICS, ASSIGNMENTS
5 Aug 28 (Wed) 9:15-10:30; 10:45-12:00	Case: L. L. Bean, Inc. (5-895-057) 1. How does L.L Bean use past demand data and a specific item forecast to decide how many units of that item to stock? 2. What item costs and revenues are relevant to the decision of how many units of that item to stock? 3. What information should Scott Sklar have available to help him arrive at a demand forecast for a particular style of men's shirt that is a new catalog item? 4. How would you address Mark Fasold's concern that the number of items purchased usually exceeds the number forecast? 5. What should L.L. Bean do to improve its forecasting process? Supply chain coordination: the bullwhip effect and contracts.
6 Aug 29 (Thu) 9:15-10:30; 10:45-12:00	Contracts. Make-up and practice session. Putting it together? What did we learn?
7 Aug 30 (Fri) 9:00-10:30	Exam (90 minutes) on supply chain arithmetics.