



Operations Strategy

MGT 6621, Fall, 2014

Professor: Glen Schmidt

Class Times : Mondays, Nov 10, 17, 24, Dec 1 and Dec 8 from 6:00 – 10:00 p.m., in SFEBB 1180

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Office Hours: By appointment.

Required texts: Most course documents are posted in on the Canvas Home page; two case studies are acquired in one purchase at <http://cb.hbsp.harvard.edu/cb/access/16096416> . The book “On the Mend” is available in Kindle format at Amazon.com for \$7.99.

Course Description:

Business Strategy suggests that a firm derives competitive advantage either by achieving a cost advantage, or through product differentiation (Michael Porter, *Competitive Advantage*, Free Press, NY, NY, 1985). That is, either the firm must be able to produce its goods at a lower cost (through process innovation), or it must offer features that customers desire and competitors lack (through product innovation). We explore specific operational strategies that the firm might pursue to achieve this superior process or product innovation. Within each topic, we develop a framework, or theory, that the firm can use as an aid in its decision-making process, and also tackle a real-life problem through a case study. The topics are as follows:

- 1) **Introduction: The Dynamics of Innovation** – Innovation in any industry seems to follow a somewhat predictable pattern. For example, we are in the midst of a cycle of innovation involving the internet. What has happened so far has been “predictable” in the sense that the industry has completed the phases of the birth and turbulence, and is now in a build-out phase. Another somewhat predictable notion is that of the establishment of a “dominant design” within an industry.

How might a firm's operations strategy differ as a function of the phase that the industry is in (birth, turbulence, or build-out), and as a function of whether a dominant design has been

established? These are rather open-ended “big picture” questions, but ones that can help frame our discussion of product and process innovation.

- 2) **The Product Development Supply Chain** – What is the process by which a firm generates new products and services? We address this question by looking at how a pre-eminent firm (IDEO) manages the process of new product development. Parenthetically, note that the field of operations management deals with managing processes; here we look at managing the process of developing a new product or a new service (such as a banking transaction).
- 3) **Strategic Implications of the Learning Curve** – Cost reduction takes place in a somewhat predictable way. We examine how the firm can take advantage of this predictability, which is described by the learning curve principle, and we look at how the firm might use this predictability to its strategic advantage. Discussion will be based in part on the case entitled *The Growth of Intel and the Learning Curve*.
- 4) **Process Innovation: The Toyota Production System (TPS)** – The TPS has become the benchmark for the production of goods and services. What are the key elements of the TPS and how can the TPS be applied in industries other than automotive? The case study of Virginia Mason allows us to address these questions.
- 5) **Encroachment Strategies** – By enhancing its cost position through process innovation, or achieving differentiation through product innovation, a firm *encroaches* on the competitor’s market (or, possibly on its own market, as Intel typically does when it introduces a faster Pentium microprocessor). We find there are two possible encroachment strategies that the firm can pursue: *High-end encroachment* (generally associated with sustaining technologies) or *low-end encroachment* (possibly resulting from disruptive technologies). We use the case of *Seagate and Quantum* in the disk drive industry to study the strategic implications of these two possible strategies.
- 6) **Process Innovation: Lean Operations** – We take a further look at lean operations from the perspective of Theda Care in Wisconsin, in the book “On the Mend.”
- 7) **Outsourcing of Design and Manufacturing** – Flextronics has historically been strictly a contract manufacturer, simply producing the designs of other manufacturers. It is considering vertically integrating into design, such that it can offer “one-stop shopping,” that is, so it can offer a complete package, from design to production. We examine some of the issues faced in deciding whether to integrate in this fashion, from the perspective of both Flextronics and its customers.
- 8) **Competing Through Mass Customization** – We next explore whether the firm must really choose between low cost and differentiation, or whether it can simultaneously achieve *both* – through mass customization (mass producing customized products). Historically there has been a tension between these two production paradigms – Customization is desirable because it gives customers exactly what they want (they will pay more for the product), but on the other hand mass production is desirable because it achieves low cost. We use the case study of *National Bicycle Company* to motivate our study.
- 9) **Demand and Revenue Management** – The decision regarding the assortment of products to offer (e.g., such as mass customized products) is intricately intertwined with the decision of what prices to charge for the products offered. We examine how firms might approach pricing and demand management through the case of SkyJet.
- 10) **Adopting Risk in Operations Strategy** – We finish by looking at how the firm may want to adopt risk as an operations strategy – assuming that its customers are willing to properly compensate them for adopting such risk.

Grading :	Assignments	40% (13.33% each, weeks 2, 3, 5)
	Final Exam	35%
	Class Participation	25%

Cases studies:

Students will turn in answers to selected questions as indicated in the attached pages. You can, and are encouraged to, discuss the assignment with student peers in your class. However, you must turn in your own individual assignment, which cannot be a copy of another person's assignment. What you turn in must be your own work. In other words, if you work through a spreadsheet together, you must individually do your own spreadsheet as you work through it with another student. You may have effectively the same numbers, but you must have created the spreadsheet yourself. On the other hand, your verbiage will not be (must not be) identically the same as that of another person. If it is, you will receive a zero on the assignment. This is because the way you express an idea will be different than the way another person expresses an idea. In other words, you can discuss the assignment with others to gain some consensus on what the answers are, but the way you express those answers will necessarily differ.

Students are expected to prepare for class discussion on all cases and all case questions, including those that are not turned in for formal grading.

Expectations on reports and assignments: here is how I would describe my expectation:

Give the bottom line as the top line, but not the only line.

That is, first succinctly give your recommendation or a summary of your answer, and then follow that recommendation/summary with some justification. We have a saying in Operations, "In God We Trust, all others bring data." In other words, unless you are God, you need to justify your answer. The amount and type of justification that is appropriate will depend on the context of the assignment. If you are using logical arguments, be sure to briefly lay out the logic. If you are using numbers from a simulation, for example, provide the numbers (possibly a summary of the numbers will suffice; use good judgment). If you are doing a problem, show the calculations that you cannot do in your head. Unless explicitly stated otherwise, you should assume that you must justify your answer.

Final Exam: A final exam will be given at the time scheduled by the registrar.

Class Participation:

Students are expected to be prepared for each class. Participation is encouraged, because every student can make a unique contribution. Insights are often better brought to life by students than by the instructor. Additionally, class participation helps prepare the student for business situations where the firm's strategies must be debated and articulated. Participation will be evaluated on impact, meaning students should consider the *quality* of their verbal contributions rather than simply aiming for quantity. Students should NOT assume that attendance by itself merits a full participation score, but SHOULD assume that not being in attendance detracts from the participation score.

Note that 1/4 of your grade will be based on participation. The course is a case-based course meaning that to be able to contribute high-quality input during our discussions, you must have read the cases and thought about the issues. The assignments that you turn in are

primarily quantitative in nature, while the more qualitative aspects of the cases will be discussed in class.

Updates: The professor reserves the right to update or modify this syllabus during the semester.

Honor Code: All students must abide by the University Honor System and be of upstanding moral character.

Timeliness: HOMEWORK WILL NOT BE ACCEPTED LATE, AND MAKE-UP TESTS WILL NOT BE OFFERED (only extraordinary circumstances will justify an exception, and any exception must be pre-approved).

Operations Strategy, Fall, 2013

This is just a summary; see the following pages for further details for each session.

1a	Nov 10	Topic: Introduction – <i>The Dynamics of Innovation</i> Readings: The Genius of [Apple's] Steve [Jobs] Excerpts from Intel's 2001 Annual Report Product Fundamentals (teaching note)
1b	Nov 10	Topic: <i>The Product Development Supply Chain</i> Readings: Democratizing Innovation (excerpt) The Newsvendor Model
2a	Nov 17	Topic: <i>Strategic Implications of the Learning Curve</i> Case: "The Growth of Intel, and the Learning Curve," Stanford U. S-OIT-17 Optional: "The Nature of Exponential Change," Stanford Teaching Note
2b	Nov. 17	Topic: <i>Process Innovation: The Toyota Production System</i> Case: "Virginia Mason Medical Center"
3a	Nov. 24	Topic: <i>Encroachment Strategies</i> Case: "Seagate-Quantum: Encroachment Strategies," Georgetown/Northwestern U. Readings: "Encroachment Strategies" Georgetown/NW case supplement "The Encroachment Framework," Teaching note.
3b	Nov 24	Topic: <i>Competing Through Mass Customization</i> Case: "National Bicycle Industrial Co.," The Wharton School Readings: "Mass Customization," Georgetown Teaching Note POM-12
4a	Dec 1	Topic: <i>Process Innovation: Speculative and Reactive Capacity.</i> Readings: "On the Mend" NPR Clip
4b	Dec 1	Topic: <i>Outsourcing of Design and Manufacturing</i> Case: Flextronics International Ltd.
5a	Dec. 8	Topic: <i>Demand and Revenue Management</i> Case: Yield Management at SkyJet Readings: "Intro to Theory & Practice of Yield Management" by Netessine & Shumsky
5b	Dec. 8	Topic: <i>Adopting Risk as an Op's Strategy</i> Readings: How to Build Risk into your Business Model
	Dec. 8	Final Exam

Nov 10, Session 1-a: Introduction

Readings:

1. Excerpts from Intel's 2001 Annual Report (Canvas Home page, Session 1)
2. The Genius Behind [Apple's] Steve [Jobs] (Canvas Home page, Session 1)
3. Explore the "Renaissance Innovator" site <http://renaissanceinnovator.com/what-is-this/>, including some of the links at the right-hand side of the page – for example, <http://renaissanceinnovator.com/2012/03/04/what-is-the-best-way-to-innovate/#more-639>
4. For further reading (not required): Excerpts from *Mastering the Dynamics of Innovation* (you can purchase the book on Amazon.com, but again, this is NOT required).

Assignment to prepare for class (not to be submitted):

1. Think about what has happened with regard to the internet. What phase of the innovation cycle is the industry gone through? Has what we have seen been predictable in any way?
2. There are two basic strategies for creating competitive advantage – either you sell something that nobody else sells (we call this product innovation) or you can sell it at a lower cost (we call this process innovation – we will also include in process innovation the prospect of distributing your product differently, for example Amazon has innovated the way products are sold and delivered). The links that you explored on the "Renaissance Innovator" site are describing process innovation – what those authors are calling "Business Model Innovation" are effectively what I have called "Process Innovation." Please come to class with 2 examples of "Business Model Innovation", either from the web site or from your own experience.

Nov 10, Session 1-b: The Product Development Supply Chain

Readings:

1. "Democratizing Innovation" Chapter 1, available here: <http://web.mit.edu/evhippel/www/democl.htm>
2. "The Newsvendor Model" (if you took my core class you will recognize this framework, but please refresh your memory as we will use it as a tool for helping "solve" several cases). (Canvas Home page, Session 1)

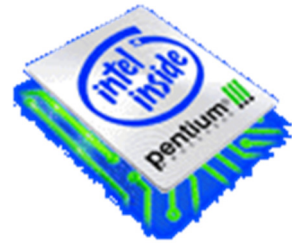
Assignment to prepare for class (not to be submitted):

1. Go to the web site <http://www.ideo.com/ideo.asp> and browse some of the links in order to be able to answer the following question: How would you characterize IDEO's process, organization, culture and management?



Readings:

1. “The Growth of Intel, and the Learning Curve,” Stanford U. S-OIT-17 (Canvas Home page, Session 2)
2. Optional: “The Nature of Exponential Change,” Stanford Teaching Note (Canvas Home page, Session 2)



Assignment to prepare for class: Turn in answers to the questions below.

- 1) What is Intel’s strategy regarding updating of their product line (frequency and magnitude)? One might argue that this strategy relies on the cost reductions achievable for transistors over time. Are there any threats that might cause them to alter their strategy?

There are two factors that contribute to Intel’s rapid cost reduction: 1) The learning curve (costs go down as more is produced), and 2) Exponential growth in sales. To find out how significant each factor is, we will first calculate the learning rate, and then calculate the sales growth rate.

- 2) What is your estimate of the learning rate for the data given in Table 2 of the Intel case? (Using data given in Table 2 of the case, apply the four-step process given in the appendix to the case, to generate a graph similar to that of Figure A-2 in the case. Assume that the number of bits sold is the same as the number of bits produced. Thus, x is the cumulative number of bits sold, and Y_x is the cost per bit.) There is an Excel Spreadsheet posted on the Canvas Home page that you can use as a template in conducting the analysis.
- 3) What is the (instantaneous) growth rate in demand for transistors? To find this, proceed as follows, using the data in Table 2:
 - Plot the natural log of the cumulative number of bits sold against time.
 - Fit a straight line to this data.
 - Find the slope of this straight line. This is the instantaneous rate of growth in cumulative bits sold, which we can synonymously call the “interest rate.” (This problem is equivalent to a problem involving continuous compounding of interest.)
- 4) How long does it take for demand to double? To find this, use the “Rule of 72.” (The “Rule of 72” says you divide 72 by the percent interest rate to get the number of years it takes to double your investment. For example, if you receive 8% interest on your investment, your investment doubles in $72 / 8 = 9$ years.) For more accuracy, use the “Rule of 69.3” (the “Rule of 72” assumes annual compounding, while the “Rule of 69.3” assumes continuous).
- 5) Calculate the growth rate for an investment in Intel stock from its IPO. (Go to <http://www.bigcharts.com/intchart/frames/frames.asp?symb=intc&time=&freq=> or to <http://quote.yahoo.com> and get a plot of stock price versus time (Intel’s ticker symbol is INTC). Make sure the “y” axis of the plot is a logarithmic scale. Draw a straight line through the data. Find the slope of the line.) Compare with the S&P.

- 6) Consider the learning curve for automobiles. In the case note, it suggests a learning rate of 89% for the Model T. But this is for the entire vehicle. What would it be for an average PART (or component) within the vehicle? To find out, let's assume each Model T consisted of 1,000 parts (a car today consists of about 10,000 parts, but clearly, the Model T was a more primitive "animal"). Then, for an average part, the price would be one-thousandth of the vehicle price as given in Table A-1, and the yearly production would be 1,000 times the yearly production as given in Table A-1. What is the learning rate for an average part?
- 7) Bill Gates is reported to have made the following statement: "If automobile companies had only achieved the same level of improvement as the computer industry, we wouldn't have the environmental concerns that we have today. Cars would be getting thousands of miles per gallon, they would travel as fast as airplanes, and they would weigh only a few pounds. Yet they would be safe, reliable, and affordable." How might you respond? In your critique of this statement, discuss how the learning curve suggests improvements in the two industries progress. Namely, address the issues of learning rate (e.g., why do you suspect the learning rates might differ between these industries), and consider "how far down the learning curve" the products are.

Nov 17, Session 2-b: Process innovation: The Toyota Production System
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Readings: "Virginia Mason Medical Center" (Purchase at the link provided on the front page of this syllabus).

Assignment to prepare for class (not to be submitted):

1. What is Gary Kaplan trying to achieve at Virginia Mason?
2. How does the Toyota Production System fit into his strategy?
3. What is your view of the "people are not cars" debate?
4. Is Kaplan's approach transferable to other hospitals?

Readings:

1. “Encroachment Strategies...” (Canvas Home page, Session 3)
2. “The Encroachment Framework” (Canvas Home page, Session 3)
3. Seagate-Quantum: Encroachment Strategies” (Canvas Home page, Session 3)



Assignment to prepare for class: turn in answers to the following questions.

1. If you were Seagate, would you introduce a 5.25 inch drive? Estimate pricing, market share, and profitability at introduction, and after 1, 2, 4, 6, and 7 years following introduction. There is an Excel Spreadsheet on the Canvas Home page that you can use as a template in conducting the analysis.
2. If you were Quantum, how would you react to Seagate's new product introduction strategy?
3. Marketing's "view of the world" seems to be that new products diffuse through the market because of "social influences." In other words, the point at which people switch to the new product is determined by how much social pressure has been exerted on them. Different personality types require different amounts of social pressure to make the switch. First, only "innovator-types" buy the product. Then "early adopters" become convinced, followed by the "early majority." The "late majority" types are risk-averse and are exceeded in their reluctance to convert only by the "laggards." How does the encroachment view compare with this marketing view?
4. What are the possible scenarios under which the electric car might make inroads into the automotive market? (Describe both a low-end encroachment scenario and a high-end encroachment strategy. In your discussion, identify who are the first customers, from what segments does the market grow, etc. In what time frame do you envision the electric car, or some other alternate fueled vehicle?) Which of these strategies would you choose if you were a manufacturer?

Readings:

1. "Mass Customization" (Canvas Home page, Session 3)
2. "National Bicycle Industrial Co." (Canvas Home page, Sess 3)



Assignment to prepare for class (not to be submitted)

- 1) Assess the profitability of the proposal for the factory. To do so, add a second column to Exhibit 12 that addresses a customized bike. In other words, use the data in the case, and your best judgment, to determine "purchased parts and materials," "labor," "factory overhead," "transportation," "inventory carrying," and "S&A" expenses for the customized bike as well as the retail price. Assume the retailer wants the same margin on a customized bike as it gets on a make-to-stock bike. Compare the factory's profit margin for a customized bike to the 3500 yen that the factory makes on a standard bike (the factory sells the bike for 70,000 yen as compared to a total cost of 66,500 yen). Then, calculate the payback time (how many years will it take to recoup the 300 million yen investment).
- 2) Assess the profitability of the proposal for the dealer. That is, use the data in the case to find out what expenses the dealer incurs in going to the customized bike (the dealer has to buy 3 things). Then estimate how many bikes the dealer will sell during the time period over which this investment will be amortized.
- 3) Aside from the numbers you calculate above, what arguments might you make in favor of, or against, implementing the mass customization option?
- 4) What needs to be done to achieve a 7-day lead time?
- 5) What is your recommendation?

Dec 1, Session 4-a: Process Innovation – Lean Operations

Readings:

1. Chapters 1-5 of “On the Mend”, available for \$7.99 at Amazon in Kindle version (you don’t need a Kindle; just download the software on your PC or Mac).
2. Listen to the NPR audio clip or read the Transcript (both are posted on the Canvas Home page, Session 4).

Assignment to prepare for class (not to be submitted):

1. What are the three key principles of lean healthcare as adopted by ThedaCare?
2. How would you summarize and implement lean operations at your firm (or your former firm)?

Dec 1, Session 4-b: Outsourcing of Design and Manufacturing

Readings:

1. “Flextronics International Ltd.” (purchase at the link shown on the front page of this syllabus)
2. “How Did the Robot End up with My Job”? (Canvas Home page, Session 4)

Assignment to prepare for class (not to be submitted):

- 1) What factors account for the dramatic growth of the electronics manufacturing services (EMS) industry during the 1990s? How would you rate Flextronics’ performance during this period?
- 2) Does the economic or strategic rationale for the outsourcing of electronics manufacturing differ from that for outsourcing of design? If so what is different?
- 3) Do you believe that moving into the ODM market is a good idea for Flextronics? If yes, explain your rationale and decide whether you would grant an exclusive relationship for Phone 4. If not, what alternate strategy would you recommend?

Dec 8, Session 5-a: Demand and Revenue Management

Readings:

1. “Intro to Theory & Practice of Yield Management” (Canvas Home page, Session 5)
2. Case: “Yield Management at SkyJet” (Canvas Home page, Session 5)

Assignment to prepare for class: turn in a solution to the booking limit for each day of the week beginning March 18.

SkyJet’s yield managers have collected the daily demand for full-fare tickets over the previous 12 months (note that these are estimates of actual demand, not the number of tickets sold). These data are available in an Excel spreadsheet posted on the Canvas Home page, Session 5.

Find the optimal (profit-maximizing) protection level for full-fare seats and the optimal booking limit for economy-class seats for each day of the week beginning on March 18. You should find 7 protection levels and 7 booking limits, the best possible pair for each day of that week.

Hint: Use the newsvendor (cost of holding back too few seats, and cost of holding back too many) to figure out the critical fractile. This will be the same no matter what day of the week you are dealing with.

Then translate the critical fractile into a booking limit (that is, into the number of seats to hold back) by first finding the average and standard deviation of the demand. There are several levels of intensity at which you can do this, as outlined below. “Level 1” is the least difficult and the difficulty increases from there; simply pick a difficulty level that you are comfortable with. (For example, if level 2 seems manageable but level 3 seems too difficult, then simply do what is suggested in Level 2).

Level 1: Simply use all 365 days worth of data and find one mean and one standard deviation. Thus you will end up with one recommended booking limit to cover any and all days of the year.

Level 2: Treat the data as 7 different data sets, one for each day of the week, finding 7 different means and 7 different standard deviations. Thus you will end up with seven recommended booking limits to cover the 7 days of the week.

Level 3: Treat the data as 1 data set but use zero-one indicator variables to identify the day of the week, and run one multiple linear regression to determine the regression intercept and coefficients associated with each day of the week. Again, you will end up with 7 booking limits to cover the 7 days of the week. You can use the standard error of the regression as a surrogate for the standard deviation. (Working with the data in Excel, make a column for Mon, Tues, Wed, Thurs, Fri, and Sat. If the data point is a Monday, then it gets a “1” in that column and a “0” in the other columns (Sun has “0” in all columns). Do a similar thing for the season of the year. Then use the “linest” function in Excel to get the regression parameters.)

Level 4: By plotting the data you will notice that there is seasonality in the demand (higher demand in the winter – after all, the flight is to Denver, so this reflects the ski season!). To account for both seasonality and day of week, treat the data as 1 data set but use zero-one indicator variables to identify day of the week and also use zero-one indicator variables to identify season of the year. Run one multiple linear regression to determine the regression intercept and coefficients associated with each day of the week and each season of the year. You will end up with seven recommended booking limits to cover the 7 days of the week, which apply to the specific season of the year within which March 18-24 falls.

Level 5: Impress me. (Not that a lesser level won’t...)

Your submission should include writeup that explains what your approach to the analysis.

Dec 8, Session 5-b: Adopting Risk as an Op's Strategy

Readings: “How to Build Risk into your Business Model” (You can download this for free from the home page of the Marriott Library – we will do so in the first class session).

Assignment to prepare for class (not to be submitted):

- 1) Usually we want to reduce risk. Thus how can you make sense out of this article?