

**BUSI 790**  
**Management of Technology**  
**June 2007**

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 Meeting Dates and Times: June 6 -10, 2007  
 8:30 – 4:30

**Course Text**

- Course pack with cases and readings.
- Book: *Strategic Management of Technological Innovation*, 2<sup>nd</sup> Edition, by Melissa A. Schilling. McGraw Hill, 2006. ISBN: 978-0-07-321058-2.
- Reading on BB.

**Course Description and Objectives**

The objective of this course is to expose students to a variety of strategic and operational issues that arise when managing in the presence of technological innovation, and to provide techniques to approach these issues. We cover the formulation of innovation strategies, the process of developing new products and services, and the implementation of process technologies aimed at improving productivity (manufacturing and services).

**Course Web Page:**

On Blackboard (BB). <http://bb.rhsmith.umd.edu>. Please update your email address in Testudo to ensure you receive course communications.  
[\(http://www.testudo.umd.edu/apps/saddr/\)](http://www.testudo.umd.edu/apps/saddr/)

**Grading:**

The final grade is based on your final number of points, out of a maximum of 1000 points, distributed as follows.

- |                             |            |
|-----------------------------|------------|
| • Case Write-ups (Pre-work) | 300 points |
| • Class participation       | 200 points |
| • Group Case                | 200 points |
| • Take-home final exam      | 300 points |

**Class Procedure**

It is *expected* that each student will have read the assigned material before he/she comes to class for the given day.

Students are highly encouraged to discuss their own work experience when relevant to the class material. Class attendance is *required* and counts towards your participation grade (20%).

Please bring a laptop (and wireless card) if you have one for in class exercises and case analyses. A calculator is highly recommended as well.

Each day has been organized into 4 sessions. They will run approximately from 8:30-10:00, 10:30-12:15, 1:00-2:30, and 3:00-4:30. Adjustments will be made as necessary.

### **Academic Integrity**

The University's *Code of Academic Integrity* is designed to ensure that the principles of academic honesty and integrity are upheld. All students are expected to adhere to this Code. The Smith School does not tolerate academic dishonesty. All acts of academic dishonesty will be dealt with in accordance with the provisions of this code. Please visit the following website for more information on the University's Code of Academic Integrity: <http://www.studenthonorcouncil.umd.edu/code.html>

On each assignment you will be asked to write out and sign the following pledge. "*I pledge on my honor that I have not given or received any unauthorized assistance on this exam/assignment.*"

For practical purposes, the meaning of the code for this class is:

- Exam: use only authorized materials (to be defined for each exam); no consultation with existing or former students (or anyone else) is allowed.
- Pre-work case write-ups consist of original ideas from the student alone.

### **Examination:**

There will be one final exam with a weight of 300 points toward the final grade. The exam is open book and notes. It will be *take-home*, with an expected duration of 3 hours (although you'll have a longer time to do it than that). No collaboration is permitted.

### **Special Needs**

Any student with special needs should bring this to the attention of the instructor as soon as possible, but no later than the second day of class.

**Pre-Work:** Please choose 3 of 5 cases listed below and write a one page response to the questions for each of the 3. Choose from Team New Zealand (A), GolfLogix, Carrier Aquasnap, Bank of America, or Medtronics. Due 6/4.

I also recommend that you do as much of the reading as possible before the week begins.

**Group Case:** Form groups of x people. You will analyze either the the Bharti Airtel Limited Case or the Siemens Global case as assigned the first day. Turn in a 4-5 page write-up (one per group) and present your solution. Due 6/10 8:30 am.

**BB Polls:** For the following cases, please enter your votes for the poll by 8 am the morning of the case. (Part of class participation.)

Seagate/Quantum  
Team New Zealand  
GolfLogix

## TENTATIVE CLASS SCHEDULE AND ASSIGNMENTS

Day	DATE	TOPIC	ASSIGNED READING(s) (Readings are in the course pack. ** readings are on BB, Schilling refers to the required text))
	5/29	Please post Biography on BB. See Below.	
	6/4	Pre-Work Please email me the assignments. Also keep a copy handy to use during class.	
<b>I – Introduction</b>			
1a	6/6	--Introduction to MOT --Types of innovation --Dominant designs	--Schilling, Chapter 1, Chapter 3 --BW Online, <a href="#">Dawn of the Idea Czar</a> , 4/10/06
1b	6/6	-- Organizing for technological change: the role of corporate R&D	--Schilling Chapter 2 --Case: Managing IBM Research in Internet Time (HBSP #9-601-058) --Supplement to case: <a href="#">How Big Blue is Turning Geeks into Gold</a> ," <i>Fortune</i> , Vol. 147, No. 11 (June 9, 2003).
1c 1d	6/6	--Disruptive technologies	--Bower, J., and C. Christensen (1995), " <a href="#">Disruptive Technologies: Catching the Wave</a> ," <i>Harvard Business Review</i> , Jan-Feb, 43-53. --**Case: Seagate-Quantum: Encroachment Strategies (on BB) --**Supplement to case: "Seagate-Quantum: Encroachment Strategies"
<b>II – Project Level</b>			
2a	6/7	--Product development strategy --Product and portfolio planning --Product development process --Product development economics --Design for X	--Case: Carrier Corporation, Montluel, France: The Aquasnap Design Project (Darden Case UVA-OM-0972). --Schilling, Chapters 7, 11 and 12 --Schilling, p. 218-219. --Note: "Product Development: A Customer Driven Approach" (HBSP #9-695-016) --Ulrich, Karl (1995), " <a href="#">The role of product architecture in the manufacturing firm</a> ," <i>Research Policy</i> 24, 419-440. OPTIONAL
2b	6/7	--Product development process --Project planning	--PD In-Class Exercise --Iansiti, M., A. MacCormack (1997), "Developing Products on Internet Time" <i>Harvard Business Review</i> , September-October 1997 OPTIONAL.
2c	6/7	--Experimentation and Prototyping --Services and Products --IDEO Video	--Case: Team New Zealand (A) (HBSP #9-697-040) -- " <a href="#">The Power of Design</a> ", <i>Business Week</i> , May 17, 2004.
2d	6/7	--Experimentation and Prototyping --Services and Products	--Case: Bank of America (A) (HBSP # 9-603-022)

III – Program, Portfolio			
3a	6/8	--Moore's Law --The learning curve	--Case: The Growth of Intel, and the Learning Curve (Stanford-OIT-27)
3b	6/8	--System level design, product architecture	--Case: We've Got Rhythm! Medtronic Corporation's Cardiac Pacemaker Business (HBSP # 9-698-004) --Wheelwright, S., K. Clark (1992), " <a href="#">Creating Project Plans to Focus Product Development</a> ," <i>Harvard Business Review</i> , March 1992.
3c	6/8	--Knowledge Management	--Case: Meridian Magnesium: International Technology Transfer (Ivey School of Business #9B01M006) --Clark, Don (2002), " <a href="#">Inside Intel, It's All Copying</a> --- In Setting Up Its New Plants, Chip Maker Clones Older Ones Down to the Paint on the Wall," <i>Wall Street Journal</i> . (Eastern edition). New York, N.Y.: Oct 28, 2002. pg. B.1. --Schilling, p. 220-223.
IV– Firm and Network			
3d	6/8	--Creating an Innovation Culture	--Case: 3M Optical Systems: Managing Corporate Entrepreneurship (HBSP #9-395-017)
4a	6/9	--Technology forecasting: diffusion	--Schilling, p. 47-54 --Norton, John A., Bass, Frank M.. " <a href="#">Evolution of Technological Generations. The Law of Capture</a> ," <i>Sloan Management Review</i> . Winter 1992. Vol. 33, Iss. 2; p. 66 --In-Class Exercise
4b, 4c	6/9	--Technology Scanning and Sensing --Collaboration/Networks of Innovation	--Schilling, chapter 8 --Case: Intel Research: Exploring the Future (HBSP #9-605-051) --BW Online, " <a href="#">How Whirlpool Defines Innovation</a> ", March 6, 2006. --Connect and Develop," <i>Harvard Business Review</i> , March 2006. --Case: Microsoft.net (HBSP#9-602-086)
4d	6/9	--The role of supply chain design in innovation --Channel choice	--Schilling, p. 288-290. --Fine, C. (2000), "Clockspeed-Based Strategies for Supply Chain Design," <i>Production and Operations Management</i> , 9, 3, 213-221. --Case: GolfLogix (HBSP #9-503-004)
5a	6/10	--Make vs. buy	--Refer back to Schilling, chapter 8 --" <a href="#">Outsourcing Innovation</a> , <i>BW Online</i> , March 21, 2005. --Case: Strategic Outsourcing at Bharti Airtel Limited (HBSP #9-107-003)
5b	6/10	--Global innovation	--Case: Siemens AG: Global Development Strategy (HBSP #9-602-061)
	6/19	Take Home Final Due	

**Biography:**

Please prepare a short biography of yourself. What interests you about this class? Where do you work now and in the past? Do you have experience in the innovation or product/service development areas? Please include a picture of yourself and submit it to the BB discussion forum entitled biographies. Due 5/29.

**Case Questions:****Managing IBM Research in Internet Time:**

1. What is the role of basic research at IBM?
2. Why has IBM historically struggled to get projects out of its research organization and into its business units?
3. IS IBM's research organization well-positioned to exploit the Internet? Why or why not?
4. What should Paul Horn do to have the Research Division contribute to Gerstner's vision of "network-centric computing"?

**Seagate-Quantum: Encroachment Strategies**

**Please just read the case and supplement. We will work on this in class.**

1. If you were Seagate, would you introduce a 5.25-inch drive? Estimate pricing, market share, and profitability at introduction, and also at one year, two years, four years, six years, and seven years after introduction.
2. If you were Quantum, how would you react to Seagate's 5.25-inch product introduction strategy?
3. If you were Seagate, would you introduce a 1.8-inch drive? Estimate pricing, market share, and profitability at introduction, and also at one year, two years, four years, six years, and seven years after introduction.
4. If you were Quantum, how would you react to Seagate's 1.8-inch product introduction strategy?
5. One "view of the world" seems to be that new products diffuse through the market because of communication. Some personality types buy because of communication external to the social system (these customers are sometimes called "innovators") while others require communication internal to the social system (these are "imitators"). At 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 reservation price perspective compare with this marketing view?
6. What are the possible scenarios under which the electric car might make inroads into the automotive market? Describe a fringe-market low-end encroachment scenario, a detached-market 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. Which of these strategies would you choose if you were a manufacturer?
7. Describe how hybrid vehicles were introduced? Which type of encroachment strategy was used?

### **Carrier Corporation, Montluel, France: The Aquasnap Design Project.**

1. How should Thierry Jomard think about the Aquasnap decision?
2. Conduct an economic analysis (NPV-type) for the Carrier Aquasnap case with the objective to identifying whether the integrated hydronic kit should be adopted in the Aquasnap design. Use the data from Exhibit 7 plus the following assumptions. (*IF* necessary, make additional assumptions as you see fit.)
  - Time horizon: 1998-2002
  - Time period: use years
  - Factory selling price for Aquasnap with hydronic kit: 41,357 FF
  - Aquasnap total cost with hydronic kit: 29,790 FF
  - Cost of hydronic kit (3,900 FF) is passed to customer, i.e., the % profit margin (cost/price) for the two options (with and without hydronic kit) is the same.
  - Exchange rate: 1US\$ = 6 FF
  - Discount rate = 15% per year
  - Tooling costs for hydronic kit: 450,000 FF
  - Incremental testing for hydronic kit: 400,000 FF

Please conduct the analysis under two scenarios:

1. No delay in launch date
2. One-year delay in launch date. For this scenario, assume that monthly engineering costs (labor and overhead) associated with this delay are about 400,000 FF. Assume the same market share patterns from before, *after* the launch of the product.

What do you recommend?

3. What would you want to ask Thierry Jomard that might affect your recommendation?
4. What are the challenges in designing a “global” product like the Global Chiller? What organizational or other changes can help manage these challenges?

### **Team New Zealand (A)**

1. What would you advise Team New Zealand to do: build two similar boats now, build two different boats now, build one boat now, another later. Please choose only one.
2. Why? How much improvement would you expect from each?
3. How would you evaluate Team New Zealand’s use of simulation in the design process? What are its advantages and disadvantages? How did their approach to simulation differ from the other teams’ approaches?

### **Bank of America (A)**

1. How would you characterize Bank of America’s new system for developing services? Focus on its processes, organization, management and culture.
2. Compare Bank of America’s approach to other product development systems. What are the differences? What are the similarities? Does it matter if it is a physical product or service that is being developed?
3. What is the role of experimentation? How can companies maximize their learning from experimentations?

## **The Growth of Intel and the Learning Curve**

**Please just read the case. We will do the following spreadsheet analysis in class.**

1. What is your estimate of the learning rate for the data given in Table 2? Has the industry been able to sustain the 72% learning rate as given by Noyce in 1977?  
Hint: Apply the four-step process as given in the case appendix to the data in Table 2. Assume that the number of bits sold is the same as the number of bits produced.
2. Which version of Moore's Law do the data in Tables 2 and 3 reflect more closely: A doubling in the number of transistors (bits) per chip (die) every 12 months, or every 18 months?  
Hint: Plot the natural log of the number of bits per die against time. Fit a straight line to the data and find its slope. This is the rate of growth in transistors per chip. Assuming annual compounding, use the "rule of 72" to find the doubling time (i.e., divide 72 by the percent growth rate to get the number of years it takes to double).
3. The case states that between 1960 and 1977 annual usage of transistors doubled 11 times, which equates to once every 18.5 months. Based on Table 2, has the rate of growth in transistor demand continued at the pre-1977 pace?
4. Consider 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 we have today. Cars would be getting thousands of miles to the gallon, they would travel as fast as airplanes, and they would weigh only a few pounds. Yet they would be safe, reliable, and affordable." Is this true? Why or why not?

## **We've Got Rhythm! Medtronic Corp.'s Cardiac Pacemaker Business**

1. Review the history of how Medtronic nearly lost its position as market leader in the 1970s and 1980s. Chart on a piece of paper what the root causes of those outcomes were.
2. Which of the improvements in the new product development process that the Medtronic management team implemented strike you as having been particularly crucial to turning the company around?
3. What do the concepts of product architecture and train schedule mean in the pacemaker business? What are the costs and benefits of having implemented these concepts as the Medtronic management team has done? What elements of Medtronic's approach could be applied in very different business settings?
4. Evaluate the nature of senior management involvement in Medtronic's implementation of its product development system. Which elements of the system does senior management need to be intimately involved in and which can it delegate or pay less attention to?

## **Meridian Magnesium: International Technology Transfer**

1. Why is the issue of technology transfer so important to Meridian Magnesium?
2. From your perspective, why was the SF6 pulse system and gas displacement pumps technology not fully implemented by the American and French facilities?
3. List three ways in which Len Miller can fix these problems.

## **3M Optical Systems: Managing Corporate Entrepreneurship**

1. As Andy Wong, how would you handle the authorization for expenditure (AFE) for the relaunch of the privacy screen?
2. As Paul Guehler, would you approve the AFE if Wong sent it up to you?

3. How effective has Wong been as a front line manager in the 3M context? How effective has Guehler been as a 3M division president?
4. What is it about 3M that makes it a consistent entrepreneurial large company?

### **Intel Research**

1. Why do firms get blindsided by new technologies? Is Intel more or less prone to this problem?
2. Evaluate Tennenhouse's approach to designing an exploratory research organization? What are its main elements? How do these elements work together? How could its design be improved?
3. Should Intel fund projects like PlanetLab and Sensor Networks? How do they generate value?
4. How can Tennenhouse measure the performance of his organization?

### **Microsoft.net**

1. What is .NET? Does .NET represent an incremental or radical innovation for Microsoft?
2. How did .NET come about? What broader lessons do you think the .NET story provides for how major technological shifts emerge in organizations? Is this process replicable?
3. How should this initiative be managed moving forward? Be explicit about who should run it, and how it should be run. (For example, should they spin it out?)

### **GolfLogix**

1. How does xCaddie create value? Is it compelling?
2. What is the market potential for the GolfLogix devices?
3. What are the advantages of going through the golf courses? Through the retail channels?
4. If you could only choose one of the two channels, which would you choose – courses or retail?
5. Given the option of selling through both channels, what would you do?

### **Strategic Outsourcing at Bharti Airtel Limited**

1. What must Bharti do well to succeed in the Indian mobile phone market? What are Bharti's core competences?
2. Do you think Bharti should enter the core competence agreements outlined by Gupta? What do you see as advantages and disadvantages of such agreements? How do the different agreements work toward building these core competencies?
3. If you were Bharti, what major concerns would you have about entering an outsourcing agreement with IBM? With Ericsson, Nokia, or Siemens?
4. How would you structure the agreements to address your concerns and capture any advantages you identified? What governance mechanisms would you use?
5. Assume the role of IBM or Nokia. What major concerns would you have about entering an agreement with Bharti? How would you structure the agreement and governance mechanisms?

### **Siemens AG: Global Development Strategy**

1. How would you characterize Siemens global development strategy? Why does it have RDCs all around the world?

2. What are the differences between the RDCs in India, Germany, the US? How are these issues managed and resolved?
3. What has gone wrong with the ADMOSS and NetManager projects? Please consider the Bangalore and Munich perspectives.
4. What should senior management do about the NetManager crisis? Please choose one. A) Let Bangalore solve it. B) move all decision-making to Europe. C) Move entire project to Europe. Why?

### **Additional Readings**

If you are interested in additional readings on the topics of this course, I recommend a few below.

#### **1 INNOVATION AND INDUSTRIAL DYNAMICS**

*Mastering the Dynamics of Innovation – James Utterback, HBS Press*

*Clockspeed – Charles Fine, Preseus Books*

*The Innovator’s Solution – Clay Christensen et al., HBS Press*

*Harvard Business Review on Innovation, HBS Press*

*Managing Technological Innovation – Frederick Betz, Wiley-Interscience*

*Open Innovation, Henry Chesborough*

#### **2 NEW PRODUCT & SERVICE DEVELOPMENT**

*Product Design and Development – K. Ulrich & S. Eppinger, Irwin Mc-Graw-Hill*

*The Power of Product Platforms – Marc Meyer, and Alvin Lehnerd, The Free Press*

Ulrich, Karl (1995), “The role of product architecture in the manufacturing firm,” *Research Policy* 24, 419-440.

#### **3 PROCESS INNOVATION**

Thanassoulis, Emmanuel (1999), “Data Envelopment Analysis and its Use in Banking,” *Interfaces*, Vol. 29, No. 3, pp. 1–13.