

SLOAN SCHOOL OF MANAGEMENT
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
FALL 2001

15.351: INTRODUCTION TO MANAGING THE INNOVATION PROCESS

Tuesdays & Thursdays 2.30-4.00pm E51-395

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The aim of this course is to provide a solid grounding to students interested in managing various aspects of the innovation process within organizations. The course is divided into two parts. The first half of the semester focuses on analytic frameworks for managing the innovation process. This segment examines the patterns and sources of technological change and the mechanisms for capturing the economic benefits from innovation. The second half examines the strategic and organizational challenges involved in managing technological innovation. These issues include the management of technological and market leadership, attracting R&D personnel and financing, managing technical teams and alliances, project selection, and the impact of the Internet on the process of managing innovation. Case studies are used throughout.

Assigned readings are available from Graphic Arts (basement of E52) and will be distributed in two packets. The first packet contains readings through Class 7; the second packet contains the remainder of the course. When you pick up your course packet, please check to be sure that it is complete.

REQUIREMENTS, GRADING, AND DUE DATES

- **Active Class Participation.** For each class, it is expected that students will prepare readings and case studies, listen closely to class discussion, and share their ideas with others. As well, each student will take responsibility for "leading" the discussion for a minimum of two class sessions (details and sign-up will be discussed during Class 1).
- **Mini-Papers.** Each student must submit three short (one-page) "mini papers" on topics of her choice, related to the readings or discussion for a given class.
- **Final Paper: Due December 6.** This fifteen-page paper will analyze the development of a specific innovation or an aspect of the innovation process. Guidelines for the paper will be provided in class. A one-page outline will be due November 20.
- **Background Card: Due September 12.** Each student submits an index card with a photo and biographical information (educational background and professional background).

Grades are determined on the basis of class participation (40%), final paper (35%), and mini papers (25%).

15.351: INTRODUCTION TO MANAGING THE INNOVATION PROCESS

Professor Kwanghui Lim

Fall, 2001

I. INTRODUCTION AND OVERVIEW

CLASS 1. **Invention, Innovation, and Competitive Advantage** Th September 6

Rosenbloom and Cusumano, "Technological Pioneering and Competitive Advantage: The Birth of the VCR Industry," *California Management Review*, 1987.

This case-based introduction highlights several of the challenges which are special to the management of technological innovation. *Please come prepared to discuss the case.*

II. PATTERNS AND SOURCES OF TECHNOLOGICAL INNOVATION

CLASS 2. **How Does Technology Evolve Over Time?** Tu September 11 **The Technology S-Curve**

Schumpeter, J. (1943). *Capitalism, Socialism, and Democracy*, Second Edition, George Allen & Unwin, Ltd., London (GB). pp. 61, 81-86 (Prologue and Chapter 7).

Foster R. (1986), "The S-Curve: A New Forecasting Tool," Chapter 4 in *Innovation: The Attacker's Advantage*, Summit Books, Simon and Schuster: NY, pp. 88-111.

Bohn, "Measuring and Managing Technological Knowledge", *Sloan Management Review*, 1994.

What forces explain the timing of major technological transitions? Can managers predict and plan for such transitions? When should they try? What are some strategies managers might employ to predict and manage technological transition?

** INDEX CARD DUE (NAME, ADDRESS, PHOTO, BACKGROUND) **

CLASS 3. **The Co-Evolution of Technology, Firms, and Markets** Th September 13 **The Dominant Design Framework**

Utterback, James (1994), "Dominant Designs and the Survival of Firms" and "Innovation and Industrial Evolution," Chapters 2 and 4 in *Mastering the Dynamics of Innovation*, Harvard Business School Press, pp. 23-55 and 79-102.

Moore, G. (1999) "High-Tech Marketing Illusion" and "High-Tech Marketing Enlightenment," Chapters 1 & 2 in *Crossing the Chasm*, Harper Collins: NY, pp. 9-62.

These readings investigate the co-evolution of technological innovation, competition, and organizations. In what types of industries and settings do you think these models are most appropriate? What are the managerial implications of these frameworks?

CLASS 4. Technology Platforms: Organizational and Competitive Implications Tu September 18

Henderson and Clark, "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms," *Administrative Science Quarterly*, 1990.

Wheelwright and Clark, "Creating Project Plans to Focus Product Development," *Harvard Business Review*, 1992.

Successful innovation management often depends on the design and commercialization of a technology platform rather than on the development of a single "piece" of technology. Indeed, managing the reconfiguration of technology platforms is a key problem for maintaining market leadership. Why is managing a technology platform different than managing a single innovation? When is platform management most important?

CLASS 5. Applying the Frameworks Th September 20

Case: Sun Microsystems (A), HBS case 9-686-133.

Managing innovation in a complex environment involves making decisions reflecting the relationships between technology, organizations and markets. Study the case, noting how the managers respond to their technological positioning, the stage of industry evolution, and the requirements for platform leadership. What would you do if faced with this situation?

III. DEVELOPING AND PROFITING FROM INNOVATION

CLASS 6 The Foundations of the Capacity to Innovate: Does Fortune Favor the Prepared Firm? Tu September 25

Cohen and Levinthal, "Absorptive Capacity: A New Perspective on Learning and Innovation," *Administrative Science Quarterly*, 1990.

Abernathy and Clark, "Innovation: Mapping the Winds of Creative Destruction," *Research Policy*, 1985.

Supplementary Reading:

Mowery and Rosenberg, "The Institutionalization of Innovation, 1900-90," Chapter 2 in *Paths of Innovation*, 1998

The ability to successfully exploit new technologies, whether developed internally or outside the firm, seems to depend on the ability to develop and mobilize internal R&D resources and capabilities. What are some examples where “fortune” favors the prepared firm? When is market leadership independent of prior R&D capabilities? What are the managerial implications of this framework?

CLASS 7 Profiting from Innovation

Th September 27

Teece, "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy," *The Competitive Challenge*, 1987.

Martin, P., “Branded by Success,” *Financial Times*, December 12, 1996. (HAND-OUT)

The economic return on innovation depends on both the underlying value of the technology as well as the organization’s control of resources. These provide some degree of insulation from competition. We will discuss the key determinants of whether firms are able to profit from innovation and appropriate commercialization strategies in different environments.

CLASS 8 Protecting Intellectual Property: Patents and Beyond

Tu October 2

Speaker: Steven Bauer; Partner, Testa, Hurwitz, & Thibault.

Intellectual property laws are intended to enable inventors to protect the knowledge embodied in their products. How well do they do the job? What avenues are available for protecting one's ideas? How do you choose among intellectual property instruments to protect a new invention? What are some recent trends in the available types of intellectual property protection?

CLASS 9. Combining New Intellectual Property & Existing Assets

Th October 4

Case: Monsanto Co.: The Coming of Age of Biotechnology, HBS case 9-596-034.

This case presents a controversial example of an innovating firm considering a range of strategic measures to ensure that they continue to capture the value of their innovations after their intellectual property rights have expired. How might they respond to Round-Up going off patent?

** October 8th and 9th: Columbus Day Vacation.

CLASS 10 Strategy in Standards-Oriented Technology Markets

Th October 11

McGahan, A., L. Vadasz, and D. Yoffie (1997), “Creating Value and Setting Standards: The Lessons of Consumer Electronics for Personal Digital Assistants,” *Competing in the Age of Digital Convergence*, Harvard Business School Press, pp. 227-264.

Shapiro, C. and H. Varian (1999), “The Art of Standards Wars,” *California Management*

CLASS 14. **Managing Successive Technological Transitions**

Th October 25

Case: Eli Lilly: Innovation in Diabetes Care, HBS Case 9-697-101

Eli Lilly has invested heavily to retain the lead through a series of technological transitions. What mistakes did Lilly make in managing periods of creative destruction? Why were these mistakes made? Is Ellingson currently pursuing the correct agenda?

V. THE CREATION AND MANAGEMENT OF R&D ORGANIZATIONS

CLASS 15. **Recruiting R&D Personnel:**

Tu October 30

Why are Scientists and Engineers So Different?

Allen, T. (1997) "Distinguishing Science from Technology," Chapter 28 in *The Human Side of Managing Technological Innovation*, Ralph Katz, Ed., Oxford U. Press, 307-319.

Shapiro, Albert (1997) "Managing Creative Professionals," Chapter 5 in *The Human Side of Managing Technological Innovation*, Ralph Katz, Ed., Oxford U. Press, 39-46.

Supplementary Reading

Stern, S. "Do Scientists Pay to Be Scientists?" mimeo, MIT Sloan School.

Available from: <http://papers.nber.org/papers/W7410>

One of the most critical resources required for successful innovation are talented and motivated R&D personnel, organized into productive technical teams. What are some of the main idiosyncratic characteristics associated with scientists and engineers? Are there implications for the management of the innovation process?

CLASS 16 **Securing Financing for Innovation:**

Th November 1

Case: ARCH Venture Partners: November 1993, HBS case N1-295-105.

Securing R&D financing is a key challenge especially for small firms. Moreover, the terms of R&D financing may impact the organization and commercialization of a given technology. How would your preferred source of financing depend on the nature of the underlying technology or the market to be served? What are some implications of financing for R&D organization?

CLASS 17 **Team Processes for Innovation**

Tu November 6

Case: Fiat (A), HBS case 694041.

Krubasik, "Customize Your Product Development," *Harvard Business Review*, November

1988.

Supplementary Reading

Nonaka and Takeuchi, "Theory of Organizational Knowledge Creation," Chapter Three in *The Knowledge Creating Company*, OUP 1995.

Product development is a central, practical innovation activity for all organizations. If Fiat is to continue as a successful company, it must learn how to manage product development effectively. What type of development organization ought they to use and why? How might this decision be linked to the types of innovation we discussed and the types of learning described by Nonaka?

CLASS 18 R&D Project Selection

Th November 8

Case: Corning Glass Works: Tom MacAvoy, HBS case 179-074

Supplementary Reading

Nichols, "Scientific Management at Merck: An Interview with CFO Judy Lewent," *Harvard Business Review*, 1994.

Review

Wheelwright and Clark, "Creating Project Plans to Focus Product Development," *Harvard Business Review*, 1992.

Allocating scarce development resources among many projects is made substantially more difficult by organizational, political, and emotional factors. What approach for making these decisions do you support in the Corning case? How should Corning's resource allocation be modified? Does the management problem at Corning usefully fit within the Wheelwright and Clark framework?

CLASS 19 Linking Innovation Management & Technology Strategy

Tu November 13

Speaker: Throop Wilder, American Internet Corporation and Cisco Systems

VI. MANAGING INNOVATION ACROSS MULTIPLE BOUNDARIES

CLASS 20. Managing Innovation Across Firm Boundaries

Th November 15

Chesbrough and Teece, "When is virtual virtuous? Organizing for innovation", *Harvard Business Review*, Jan-Feb 1996, pp. 65-74.

Roberts and Berry, "Entering New Businesses: Selecting Strategies for Success," *Sloan*

Management Review, 1985.

Review

Gans and Stern, "The Product Market and the "Ideas" Market: Commercialization Strategies for Technology Entrepreneurs," mimeo, MIT Sloan School.

Businesses increasingly use external markets to both buy and sell R&D. Using the concepts developed throughout the course, consider the managerial and strategic implications of this choice. In the pharmaceutical and electronics industry, different companies choose to define the scope of their R&D with very different boundaries. How can we explain these differences?

CLASS 21. Investing in R&D Capabilities

Tu November 20

Case: "Molding the Impossible: The NYPRO/Vistakon Disposable Contact Lens Project," HBS case 694-062.

Technology development often requires substantial interaction with partners, suppliers and customers. How can Nypro and Vistakon learn to work together? What steps might reduce tension and increase productivity in this partnership?

Supplementary Reading

Lim, K (2000), "The Many Faces of Absorptive Capacity: Spillovers of Copper Interconnect Technology for Semiconductor Chips," MIT Sloan Working Paper 4110.

Available at: <http://kwanghui.net/>

Review

Bohn, "Measuring and Managing Technological Knowledge", Sloan Management Review, 1994.

**** HAND IN ONE-PAGE PROPOSAL FOR FINAL PAPER ****
NO LESSONS ON Thursday (22 Nov) and next Tuesday (27 Nov)
**** ENJOY THANKSGIVING! ****

CLASS 22. Learning Across Projects

Th November 29

Case: Microsoft Office: Finding the Suite Spot, HBS Case 699-046.

Cusumano and Nobeoka, "Organizational Requirements for Multi-Project Management," Chapter 7 in *Thinking Beyond Lean*, 1999.

How does the experience at Microsoft fit with the ideas of product platforms outlined by Wheelwright and Clark? Do the organizational requirements described by Cusumano and Nobeoka resonate with the Microsoft experiences – how are they similar and how might they differ due to the context for study (the auto industry in the case of Cusumano and Nobeoka)?

CLASS 23. What Has the Internet Changed?

Th December 4

Case: New Product Development at Dell Computer Corp., HBS Case 699-010.

Iansiti and MacCormack, “Developing products on Internet time,” *Harvard Business Review*, September-October 1997, pp. 108-117.

Porter, Michael (2001), “Strategy and the Internet”, *Harvard Business Review* (March)

Technology development often requires re-organization in response to changing pace of technological innovation. How would you define Dell’s products and product development process? Why has Dell’s senior management introduced the new 18-month development process? How does the Internet change Dell’s innovation processes?

VII. WRAP-UP & REFLECTIONS

CLASS 24. Technology Entrepreneurship After MIT

Th December 6

Speaker: Neil Mayle, Chief Technology Officer, Opholio

**** PAPERS ARE DUE TODAY, DECEMBER 6! ****

CLASS 25 Wrap-Up

Tu December 11

Review your notes and your thoughts. What are the most important management lessons that you learnt in this course? Please submit a brief list, outline, or note (ungraded but for future course development).