

American University of Beirut
Faculty of Engineering and Architecture
Engineering Management Program
ENMG 656: Management of Technological Innovation

Course Description:

The course is designed for **engineers** and **engineering managers** who are involved in research and development (R&D), marketing, acquisitions, and strategic assessments of new technologies. The aim of this course is to help students develop a strong conceptual foundation for **managing technological innovation**. It introduces concepts and frameworks for how firms can *create, commercialize and capture value* from technology-based products and services. Topics covered include (1) the evolution of industries and products; (2) technological change and discontinuities; (3) network effects and standards; 4) profiting from innovation and intellectual property (IP); 5) R&D management; and 6) managing knowledge and learning in organizations.

The course material covers a broad number of high-tech industries including mobile phones, semiconductors, computers, software, the Internet, telecommunications, automobiles, video games, music, videos, software, chemicals, and pharmaceuticals. However, the focus is on management rather than the specific details of any particular technology / Industry.

Learning Outcomes

1. To develop an awareness of the range, scope, and complexity of the issues and problems related to the management of technology and innovation.
2. To develop an understanding of the "state of the art" of the strategic management of technology and innovation.
3. To develop a conceptual framework for assessing and auditing the innovative capabilities of a business organization.
4. To develop insight concerning the skills necessary to be effective as a general manager in the innovation process.
5. To offer some practice in defining and working out strategic management problems related to technological innovation and corporate entrepreneurship.

Instructor:

Prof. Ali Yassine

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Office Hours: 4:00pm-5:00pm Mon. & Wed., or by appointment

Text:

Required:

Melissa Schilling (2013) Strategic Management of Technological Innovation, 4th Edition. McGraw Hill.

Examinations & Grading:

- **Final Exam** (40%). The exam is OPEN BOOK & NOTES.
- A case study per student is 25% of total grade.
- Class participation is 10% of the grade.
- Group term project is 25% of total grade.
- Dishonest conduct related to any examination or quiz will not be tolerated. Students who cheat will receive a failing grade. Cheating includes but is not limited to GIVING / RECEIVING unauthorized help and the use of unauthorized material during an examination.

Weekly Assignments / Presentations:

Each student will be assigned a case study related to the week's discussion topic. The student is responsible for preparing a 20-25 minutes presentation on the reading assignment. This activity constitutes 25% of your total grade.

The student responsible for the presentation is also responsible for reading other students' case studies. Each student must prepare a list of questions to discuss in class (minimum 1 question) about the case study presented. The 10% class participation grade is based on asking questions and making constructive comments based on and during other team's presentations.

Attendance:

A student is allowed to miss 3 lectures only. Each additional (unexcused) absence will result in reducing the student's final grade by 2 points. Missing 5 or more lectures will result in automatically dropping the course.

Term Project

Students are required to do a group project. Each team is required to select a specific industry, a specific technology, or a specific product category. The project will answer a specific question of interest. It must be a "real" question that someone wants the answer to. The text should begin with a sentence something like "This paper answers the question ...". That is, clearly state the question you are answering in the first paragraph.

The final paper should illustrate the application of one or more of the frameworks, theories, or models discussed in the class to an industry, firm, or product of your choice. It should be roughly ten pages in length. Topics could include:

- The future of fuel cells;
- Red Hat and Linux: The battle for a standard;
- Sony vs. Microsoft in the video game market;
- The future of Nanotechnology;
- AUB /Lebanon/Arab World patent database analysis for classification of patent technologies and linking it to licensing to startups or established organizations and whether this was profitable or not;
- The current state and future of green/ renewable energy in the Arab World;
- Technology S-curves in renewable energy alternatives;
- Should Google be attempting to create new technologies internally (i.e., smart goggles)?
- The future of hardware and hardware manufacturers based on "cloud computing"; and
- Management of technological innovation in Lebanese industry.

Some of the questions that must be addressed in your report are:

- Sketch the relevant S curve(s) for your industry. Is the industry likely to be subject to "natural technological limits"? Why or why not? Has it experienced "disruptions"? Is it likely to do so soon?
- How have the firms in your industry captured the value that they have created historically? What has been the relative role of complementary assets and uniqueness? Does this differ across firms? Will this change in the future?
- What are the principle drivers of industry evolution and market structure in your industry?
- Draw the value chain for your industry. Where is most of the value captured? Why? Is the structure of the chain likely to change?
- What must be their technology strategy? How to manage their technological innovation process?
- Do network externalities or standards play a role? Explain/discuss.
- Check / analyze partnerships and/or joint ventures for R&D.
- What conclusion or recommendation you have for this industry / technology / product category?

TENTATIVE SCHEDULE & READING ASSIGNMENTS

Wk	Date	Topic
1	May 26	<p>Chps. 1 & 3</p> <p>Course Overview and Introductions</p> <p>Chp. 1 The Importance of Technological Innovation Chp. 3 Types of Innovation</p> <p>Watch the documentary Triumph of the Nerds</p>
1	May 28	<p>Chp. 6</p> <p>What are core competencies of a firm? And how they become core rigidities? What is creative destruction and why does it happen?</p> <p><i>Required Readings:</i></p> <p>1. Prahalad, CK. and Hamel, G., "The Core Competence of the Corporation," <i>Harvard Business Review</i>, 1990.</p> <p><i>Supplemental Readings:</i></p> <p>2. Leonard-Barton, D., "Core Capabilities and Core Rigidities: A paradox in managing new product development," <i>Strategic Management Journal</i>, Vol. 13, 1992.</p> <p>What is strategy? What shapes strategy? What is technology strategy?</p> <p><i>Required Readings:</i></p> <p>3. Porter, M., "The Five Competitive Forces that Shape Strategy," Reprint, <i>Harvard Business Review</i>, Jan. 2008.</p> <p><i>Supplemental Readings:</i></p> <p>4. Porter, M., "What is Strategy," <i>Harvard Business Review</i>, Nov.-Dec. 1996. 5. Clark, Kim B. "What strategy can do for technology. The five rules of technology leadership." <i>Harvard Business Review</i> 67.6 (1989): 94.</p> <p>Watch the documentary Steve Jobs: One Last Thing</p>
2	June 2	<p>Chp. 3: Technology S –Curves & Technology Cycles</p> <p>Patterns of Technological Change: How do industries evolve? What determines a shakeout in the number of firms? How do dominant designs and increasing returns to scale explain shakeouts? What are the managerial implications from each explanation for incumbents and entrepreneurs? How might "dominant designs" cause a change in innovation from product to process ones?</p> <p><i>Required Readings:</i></p> <p>6. Anderson, P., and Tushman, M., "Technological Discontinuities and Dominant Designs: A cyclical model of technological change," <i>Administrative Science Quarterly</i>, Vol. 35, 1990.</p> <p><i>Optional Readings:</i></p> <p>7. Tushman, M., Anderson, P., "Technological Discontinuities and Organizational Environments," <i>Administrative Science Quarterly</i>, Vol. 35, 1986.</p> <p>8. Utterback, James M., and Fernando F. Suarez. "Innovation, competition, and industry</p>

		<p>structure." Research policy 22.1 (1993): 1-21.</p> <p>Watch the speech of Dean Kamen at TEDMED 2010</p>
2	June 4	<p>Chp. 3</p> <p>The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail.</p> <p>When successful companies put too much emphasis on customers' current needs, they fail to adopt new technology or business models that will meet customers' unstated or future needs</p> <p><i>Required Readings:</i></p> <p>9. Christensen, C., <i>The Innovator's Dilemma</i>, Harvard Business School press, 1997. 10. Bower, J., Christensen, C., "Disruptive Technologies – Catching the wave," Harvard Business Review, Jan.-Feb. 1995.</p> <p>Watch the documentary Tesla Motors: The Future of Electric Cars</p> <p><i>Case Assignment:</i> HBS Case #1: SEGWAY LLC HBS Case #2: Sharp Corporation: Technology Strategy</p>
3	June 9	<p>Chp. 3</p> <p>Technology Adoption</p> <p>How do customers adopt new technologies and products</p> <p><i>Supplemental Readings:</i></p> <p>11. Moore, G., <u>Crossing the Chasm: Marketing and selling high-tech products</u>. NY: Harper Collins, 1999. Book Summary.</p>
3	June 11	<p>Chps. 5 & 9</p> <p>Entry Timing: First-Mover Advantages. Profiting from Innovation</p> <p>How does a firm capture the economic returns from an innovation? What is the role of complementary assets? What are the advantages and disadvantages of patents, trademarks and copyrights? How a company ensure it continues to capture value from its innovations?</p> <p><i>Required Readings:</i></p> <p>12. Lieberman, M., and Montgomery, D., "First-Mover Advantages," <i>Strategic Management Journal</i>, Vol. 9, 1988. 13. Teece, D., "Profiting from Technological Innovation: Implications for integration, collaboration, licensing and public policy," <i>Research Policy</i>, Vol. 15, 1986.</p> <p>Watch the tutorial on Intellectual Property: Patents, Trademarks, and Copyright</p> <p><i>Case Assignment:</i> HBS Case #3: Kodak and the Digital Revolution HBS Case #4: Tesla Motors in 2013</p>
4	June 16	<p>Chp. 4</p> <p>Competing in Technology-Intensive Industries: Network Effects and Standards</p> <p>How do standards, network effects, and eco-systems impact on technological competition?</p>

		<p><i>Required Readings:</i></p> <p>14. Shaprio, C. and H. Varian (1998). Information Rules. Chp. 7: Networks & Positive Feedback. HBS Press, Boston, 1998.</p> <p>15. Shaprio, Carl and Hal Varian, "The Art of Standards Wars," <i>California Management Review</i>, Volume 41, No. 2, Winter 1999.</p>
4	June 18	<p>Chp. 7 Choosing Innovation Projects What type of portfolio of projects should a firm fund? How should they choose these projects?</p> <p><i>Case Assignment:</i> HBS Case #5: Chery Automotive Company HBS Case #6: Adoption of Electric Vehicles in US</p>
5	June 23	<p>Chps. 11 & 12 Managing the New Product Development Process and Teams</p> <p>New Product Development (NPD) is a key process for many organizations. It drives growth, customer value and return to shareholders. What are the tools, techniques and concepts necessary in managing and improving the development processes and the teams involved?</p> <p><i>Required Readings:</i> HBS Note: Product Development: A customer driven approach, 1996.</p>
5	June 25	<p>Chp. 10 Organizing for Innovation What are the various organizational forms / structures and which ones are more supportive of innovation and new product development.</p> <p><i>Required Readings:</i></p> <p>16. Tushman, M. L., O Reilly, C., (1996). Ambidextrous Organizations: Managing Evolutionary & Revolutionary Change. <i>California Management Rev.</i>, 38, 4.</p> <p>17. O Reilly, Charles A., and Michael L. Tushman. "The Ambidextrous Organization." <i>Harvard business review</i> 82.4 (2004): 74-83.</p> <p>Watch the documentary Battle of the X-Planes</p> <p><i>Case Assignment:</i> HBS Case #7: Browser Wars 1994-1998 HBS Case #8: Symbian, Google & Apple in the Mobile Space</p>
6	June 30	No Class
6	July 2	<p>Course Wrap-up and Review Final project presentations</p> <p><i>Case Assignment:</i> HBS Case #9: We've Got Rhythm! Medtronic HBS Case #10: Innovation at 3M Corp.</p>
7	July 7	<p>Final Exam Written report due</p>