



## Managing Technology and Innovation

Spring 2019  
MGMT 480-002

### COURSE INFORMATION

**Context:** Many managers view the challenge of technology and innovation from a functional perspective -- as an engineering problem, a marketing problem, a problem with reward systems and so on. In this course we take a general management perspective. We view the management of technology and innovation as the challenge whose solution requires creative synthesis of the skills and knowledge of finance, organization, markets, engineering and technology.

**Focus of this course:** This course will focus on the management of technology-based innovations. We will examine how industries are transformed by new technologies, how managerial action shapes product evolution, and how managerial competencies affect the innovation performance of firms. No prior knowledge of engineering and technology is required to take this course.

### INSTRUCTOR INFORMATION

Instructor: Raja Roy

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Skype ID: prof\_roy

Office: 4025 CAB

Office hours: Skype: Anytime between 10am-3pm M-F; with prior appointment (Skype ID: prof\_roy)

Meeting Time and Location: TR10-1120am; KUPF 118

### COURSE MATERIALS:

**Text:** Strategic Management of Technological Innovation, Fifth Edition, by Melissa A. Schilling.

**Case packet:** All the required cases available at <https://hbsp.harvard.edu/import/596446>

### COURSE OBJECTIVES / STUDENT LEARNING OUTCOMES

Upon completing the course, students should be able to:

- a) How industries are transformed by technological changes,
- b) How managerial action shapes and creates opportunities for value creation,
- c) How managerial competencies affect value capture (or appropriation) from new innovations.
- d) How to decide which technologies to invest in, which technologies not to invest in, and how competitors are likely to respond to technological changes.

### Course Outcome

This class will also address the following learning outcomes. Students will:

- a) Analyze business situations where a firm is trying to invest its resources to generate new innovative products, and
- b) Evaluate the pros and cons of investing in a new product innovation or a new process innovation.
- c) To analyze situations that drive firm's choices --- e.g., after taking the course students will be able to explain, "Why does Honda manufactures ASIMO robots but a similar automobile manufacturer, such as General Motors, chooses not to do so?"
- d) To analyze how decisions about whether or not to innovate affect societal and environmental sustainability—e.g., after taking the course students will be able to explain, "Why does that United States lag behind Japan, China, and most of Europe in high-speed train services?"
- e) To write "dehydrated" business plan.

### Assessment

The learning outcomes will be assessed primarily via tests, papers, business plan, and case discussions.

### STUDENTS TASKS/ ASSIGNMENTS/ REQUIREMENTS

**Class conduct:** Most sessions will be primarily in the discussion format, with a strong emphasis on the assigned cases and readings for the week. Your preparation for the class should involve a thorough analysis of the case and/or the readings and to develop a personal position. Unless you have thought about the case, it is very difficult to participate and learn from others' contributions in the class. I may call upon you at any time, whether to start the discussion or answer a specific question during the class on any day.

Because of this class format, a major part of your learning will take place in the classroom. Given that this class is largely about the development of your own personal synthesis and perspective and not just about the mastering of various analytical tools per se, *it is not possible to make up for an absence*. If, for some unavoidable reason, you have to miss a class, it is your responsibility to find out from your classmates what materials were covered, what additional assignments were given, and what handouts you may have missed.

**Grading:** Your grade will be based on the following assignments.

Category	Due date and Mode	Points
Individual homework assignments (10 points * 3 assignments)	On the day mentioned in the table in this syllabus	30
Group homework assignments (10 points * 2 assignment out of three)	On the day mentioned in the table in this syllabus	20
Class Participation (Individual)	On-going	5
Artificial Intelligence assignment (Group)		10
Mid-term quiz		10
Final quiz		10
Final project report (group)	05/15/19; 7pm ET; Electronic copy through Moodle only	15
<b>Total</b>		<b>100</b>

• *Individual Homework Assignments:* For some of the cases, you will have to answer the assigned questions that are based on the cases. The questions are mentioned later in this syllabus. Your answers to each question should be roughly 2 pages long, with 1.5 or double line spacing and 12-point font. The answers will have to be submitted strictly through Moodle only before the class when we discuss the case for the

first time. No late submissions or email or hardcopy submissions will be accepted under any circumstances. There will be more opportunities for homework grades than will be required; in other words, you may be able to skip a few assignments depending on your schedule throughout the quarter or to drop the lowest of the homework grades.

- *Group Homework Assignments:* For some of the cases, you will answer the case questions as a team. Your answers to each question should be a maximum of 2 pages long, with single or double line spacing and 12-point font. The answers will have to be submitted strictly through Moodle only before the class when we discuss the case for the first time. No late submissions or email or hardcopy submissions will be accepted under any circumstances. There will be more opportunities for homework grades than will be required; in other words, you may be able to skip a few assignments depending on your schedule throughout the quarter or to drop the lowest of the homework grades.

- *Instructional Methods:* I will use a variety of pedagogies in the class, including lectures, class discussion, interactive exercises, etc. Preparation and participation are two keys to success in this class. Prior to each class session, there will generally be a reading assignment, along with some required pre-class preparation. In class, we will engage in a number of learning activities throughout the semester, requiring your full involvement. I will strive to make the class interactive, and you must be involved on a regular and on-going basis.

- *Final project:* Dehydrated Business Plan on commercializing a new product using an Emerging or an Existing Technology. The details of the project will be discussed in the class. Some broad guidelines are as follows:

Objectives:

1. To understand the issue involved in “value” creation and capture through innovation.
2. To understand the sources of sustainable competitive advantages of a new product.
3. To understand the issues involved in the commercialization of a new product with an emerging or an existing technology.

You should be able to access information about the technology from publicly available sources, such as at NJIT Library.

Your product should be differentiated from all the existing products in your market either in the technology it uses or in the way it creates value for your customers or both. The following type of project DOES NOT fulfill the requirements for this course:

1. Products based on existing technologies and existing sources of sustainability.
2. Process innovations that are already being implemented by other companies.

Your idea should be within the limits of academic integrity. Please review your selected idea with me for approval. Your Group Memo is due by 7pm on Feb. 6 through Moodle. Please include the following information in your summary statement:

- i) Names of team members
- ii) Brief description of value creation (in about three or four sentences).
- iii) Individual responsibilities (describing how you plan to break-up the project and the responsibilities of each team members).
- iv) Milestones that you want to achieve (as a team, by date).

If two or more teams plan to pursue the same idea, then the team that had emailed me first, will get to pursue that idea for their final project. A good place to start for ideas is:

<http://www.technologyreview.com>

## **Details of the Project: Dehydrated Business Model (DBM)**

Broadly, the DBM will include your ideas to create and capture “value” from an innovation. To create value, you need to consider the type of innovation- radical (or incremental), competency destroying (or enhancing) and other ways to categorize your innovation. While capturing value, the issues that you need to consider are your competitive advantages, ways to make the competitive advantage sustainable, and the threats to sustainability. These threats include imitation, substitution, and hold-up. The issues of sustaining (or disruptive innovation) are also important. I have suggested a few sections for your report that touch upon the above-mentioned components of DBM. The relative weightage of each section, for grading purposes, is also mentioned below. A few relevant questions that you may want to explore for each section are also mentioned below. Feel free to explore additional and/or alternative issues within each section to make your report more rigorous. (*Note: If you choose, you may combine the two or more of the following sections into one larger section.*)

### 1. Value creation (or Technology analyses): Weightage: 25%

- a) What is the nature of the technology and what are its potential advantages and disadvantages?
- b) What is the state of technical development? How do you foresee the technology evolving in the next five years?
- c) What is (are) the primary competing technologies? Is that technology mature or still developing? How big a threat does that competing technology pose? Will your technology become the dominant design? Will it be able to dislodge the current dominant design from the market? What kind of innovation is your technology and/or the product? Explain.
- d) What are the various components of value creation that you think are relevant for your product (or service) and why? How do you propose to develop those sources of value creation?

### 2. Value Capture 1 (Industry and Market analyses): Weightage: 25%

- a) What are the potential applications and markets for your technology? Are there particular sub-markets and are some more attractive than others at this stage in the development of the technology?
- b) What is the size and growth rate of the market? What factors will influence the development of this market?

### 3. Value Capture 2 (or Competitor Analysis): Weightage: 25%

- a) Who are (or could be) the major competitors? Who are the major players in the field? At what stage is their technology? Assess your technology’s and product’s advantages and disadvantages compared to those of your competition. What are the uncertainties associated with your product? For example- does the current performance of your product satisfy your customers? If not, what innovations do you wish to pursue through your R&D? Will you be able to deliver the product at a reasonable cost as compared to your competitor’s products?
- b) Can your technology/ product disrupt your competitor’s business model? If so, what are the implications for your strategy?

### 4. Value Capture 3 (Strategies to Commercialize): Weightage: 25%

- a) What resources and capabilities do you need to establish sustainable competitive advantages over your competitors? How do you propose to overcome the challenges to the sustainability of your competitive advantages- imitation, substitution, and hold-ups, if any? How much technical development is needed to move the project forward toward commercialization?
- b) To what extent is there a need to develop complementary technology or supporting services? Would this require major changes in the demands placed on users of that technology, distribution channels, production technologies, or supporting services? How does this strategy affect "value creation" as discussed in point 1.d above?
- c) What are the likely vertical and horizontal boundaries of your firm? Why?

5. Additional item: Funding Requirements and Sources (Note: there are no points for this section. However, if you plan to seriously pursue your project, you will have to think about these issues in the near future.)-

- a) To the extent possible, estimate funding requirements for the commercialization process.
- b) What might be the possible sources of funding? Please note the following with respect to the written paper:

- Submit your final project report through MOODLE only.
- The paper will be typed, 12 pages in length (single or double spaced- your choice). All relevant graphs, illustrations, financial information etc. are not considered part of the body of the paper and should be placed in appendices at the end. References are also placed at the conclusion of the paper.
- Outside research is required and the sources will vary depending on the topics chosen. Please utilize the on-line databases available at NJIT library. Do not plagiarize- all assignments will be checked by Turnitin! Please mention all the sources of your information, including websites, in the Reference section.

#### **Important Additional Ground Rules:**

- *All submissions will be checked with Turnitin for plagiarism. Any submission with more than 10% plagiarism score in Turnitin will NOT be eligible for any credit.*
- Please do not pass on course materials or notes to future students or students in other sections. Such behavior will only hurt the learning of others that follow you.
- If there is any disagreement between what I mention in class and what is mentioned in the text, then my description in the class will be valid for all exams, grading, and other purposes.
- Tentative schedule is given below. This is subject to change any time during the semester.
- With regards to the final project, I will answer specific questions related to your proposed new product or service, and your target market. For example, I will gladly help you with questions such as "Is company X our likely competitor?" or "Is the measurement of our y-axis in our graph # 1 relevant for our study?" or "can southern California be a relevant market for our product or service?" However, I will NOT go through your paper, comment on the length of the paper, its contents, the number of charts, and/or similar queries prior to your submission of the final project.
- More than 3 absences will mean automatic 'Incomplete' grade for the student. Late by more than 10 minutes for a class will be counted as 'absence' from the class.

## Tentative schedule of classes:

<i>Day</i>	<i>Cases</i>	<i>Discussion topics and readings</i>
Jan. 22, 24, 29		<i>Topic:</i> <i>What/Why/When of Technological Changes</i>  Chapter 1: Introduction Chapter 2: Sources of innovation Chapter 3: Types and patterns of innovation
Jan. 31 Feb. 5		<i>Basic concepts: Imitation, substitution</i>  Group project discussion  <b>Reminder: Group Project Memo due 2/7</b>
Feb. 7, 12		Chapter 4: Standards battles and design dominance  <i>Article: The art of standards war (Available with course pack)</i> <i>Analyses of newspaper articles on Blu-ray and HD-DVD formats</i>  Chapter 5: Timing of entry Chapter 6: Defining the organization's strategic direction  <i>Topic: Make vs. Buy decisions</i> Horizontal and Vertical boundaries of the firm
Feb. 14	Synthes (Group)	<i>Note: Group memo due Feb. 8 by 7pm ET</i>
Feb. 19		Chapter 7: Choosing innovation projects Chapter 8: Collaboration strategies Chapter 9: Protecting Innovation
Feb. 21	Intel Corp.: 1968-2003 (Group)	
Feb. 26		<b>Mid-term quiz</b> <i>(Closed book; Closed notes; Multiple choice questions based on text chapters 2-6; Just reading the slides is NOT enough; read the text)</i>
Feb. 28 Mar. 5		<i>Topic: Technological disruption</i> <i>Articles: (will be available at Moodle)</i> <i>a) Disruptive technologies: catching the wave</i> <i>b) Meeting the challenge of disruptive change</i> <i>c) Will disruptive innovations cure health care?</i> <i>d) Patterns of disruption in retailing</i>
Mar. 7	HP: The flight of the Kittyhawk (Individual)	
Mar. 12	Ecton Inc. (Individual)	
Mar. 14	<i>Project Day</i>	<i>No formal meeting.</i>
Mar. 26, 28		Chapter 10: Organizing for innovation Chapter 11: Managing the NPD process  <i>Battle of X-Planes (DVD)</i>
Apr. 2, 4	Nucleon (Individual)	<i>Topic: Promises and reality check</i>  <i>Article: (Will be available at Moodle)</i> <i>Can Science be a Business? Lessons from Biotech</i>
Apr. 10, 12	<i>Topic:</i> Artificial Intelligence and its effects	<b>Artificial Intelligence assignment due Apr. 11 by 7pm ET</b>
Apr. 16, 18	<i>Project Week</i>	<i>No formal meeting</i>
Apr. 23		<b>Final quiz</b> <i>(Closed book; Closed notes; Multiple choice questions based on text chapters 7-11; Just reading the slides is NOT enough; read the text)</i>
Apr. 25		<i>Wrap-up</i> Who killed the electric car? (DVD)
May 2	<i>Project Day</i>	<i>No formal meeting</i>  <i>Final report due May 15, by 7pm</i>

### Questions for cases:

*Please note:*

- i) While answering the questions, please restrict yourselves to the information provided in the case. Also, try to imagine that this is the time when the case was written, and NOT 2019.
- ii) Please do not restate the story as your answer. For example, I am not interested in the information that Intel asked manufacturers to put “Intel Inside” logo on computers with Intel chips. I want to know “why” is that piece of information important for understanding Intel’s sources of competitive advantage?
- iii) Instead of making generic comments (such as “during technological changes, firms got to look at new markets,”), try to use theory from the course and justify “why would a firm look at new market?”
- iv) All assignments carry 10 points.
- v) At every step, think about the assumptions you make in your statements.
- vi) Page limit: 2 pages per question; 12-size font; single or double spaced—your choice.

*Question for Synthes case:*

What are the different threats to the sustainability of Synthes’ competitive advantages? Discuss. (*Hint: Recall that the threats to sustainability of competitive advantage are- Imitation, Substitution, and Hold-up. Also recall that a technology’s evolution along the S-curve affects the sources of competitive advantages).*

*Question for Intel case:*

What were Intel’s sources of competitive advantages in DRAM and how were those different from the ones in microprocessors? (*Hint: Recall that the threats to sustainability of competitive advantage are- Imitation, Substitution, and Hold-up).*

*Questions for Flight of the Kittyhawk case*

- i) What “mistakes” did HP make in executing the project? *3 points*
- ii) Are these really “mistakes” or are these rational decisions? Explain using the theories discussed in the class. (*Hint: Think about the 2\*2 matrix of technological disruption).* *7 points*

*Question for Ecton case:*

If you were the entrepreneur of Ecton, would you prepare to sell it to a large company or would you prepare to remain independent? Justify using the theories you learnt in this class (*Hint: Think about the 2\*2 matrix of technological disruption).*

*Questions for Nucleon Inc. and Can Science be a Business:*

- i) Imagine you are the Entrepreneur and CEO of Nucleon Inc. Make recommendations for Phase I, II, and III clinical trials to the shareholders and justify your recommendations. Remember: As a major stockholder, I may want to know about the financial implications (e.g., NPV) of the choices, the impact of choices made now on options later, issues pertaining to the transfer of this kind of technology, potential impacts on Nucleon's firm culture, and the impact on long-term future of the company. *3 points*
- ii) Does the biotech industry have a value creation problem or a value capture problem? Discuss based on the theories that we have covered in this class and in other classes that you have taken. *4 points*
- iii) How and why do the predictions of the Nucleon case differ from the “reality” discussed in the article “Can Science be a business?” *3 points*