

BIOE 574 – Innovation Management Strategy – Spring 2024

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OFFICE HOURS: BY APPOINTMENT

COURSE MEETING: TR, 11:00 AM - 12:20 PM, 2101 EVERITT LABORATORY

COURSE DESCRIPTION

Innovation and technology management deals with understanding how innovation affects the competitive dynamics of markets and how firms can strategically manage their innovation. Success of a firm depends on its ability to benefit from technological change, in terms of both creating and adapting to environmental opportunities and threats.

The aim of this course is to help students develop a conceptual foundation for managing technological innovations and to develop you as a professional who effectively combines technology and management skills and principles. This course introduces concepts and frameworks for how firms can create, capture, and deliver value from technology-based products, processes, and services. Topics covered includes – the evolution of industries, technology change and discontinuities, network effects and standards, profiting from innovation and intellectual property, and open innovation.

The tools discuss in the course can prove useful when, as managers or planners, you will have to decide which technologies to invest in, how to structure those investments, and how to anticipate and respond to the behaviors of competitors, suppliers, and customers.

LEARNING OUTCOMES

- To offer some practice in defining and working through strategic management problems related to technological innovations.
- To understand the foundation and implication of the dynamics of innovation.
- To develop an awareness of the range, scope, and complexity of issues and problems related to the management of technological innovations.
- To develop a conceptual framework for assessing and appraising the innovative capability and capacity of a firm.
- To be able to define an organization's technology strategy and understand how firms may manage innovations.
- To be able to calculate basic financial models for technology projects ROI.

Class sessions will utilize discussion-oriented lectures and case studies to explore the various concepts and methods associated with innovation management. Some case studies may be drawn from topics relevant to medical imaging, pharmaceuticals, diagnostics, and bio industries. Additionally, a few readings focus on foundational principles and applications will be offered throughout the course.

TEAM PROJECT

Each team is required to select a specific industry, a specific technology, or a specific product category. The goal of this project is to give you an opportunity to practice the concepts learned in

this course within a potentially real situation.

The final paper should illustrate the application of one or more of the frameworks, theories, or models discussed in the class and/or the readings to an industry, a technology, or a product of your choice. It should be 6-8 pages in length. Topics could include:

- The future of personalized medicine
- The future of regenerative medicine
- Robotic care in medical innovations
- The future of autonomous vehicles and drones in medical innovations
- Electroceuticals applications
- 3D printing for healthcare applications
- Big data analytics in the medical field
- Blockchain applications in the healthcare
- Nanoparticle innovations in healthcare
- **Team can decide!**
- **Can be based on your current BIOE 575 Project**

Key questions to be addressed in your report, in no particular order, are:

- 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? Might this change in the future?
- Sketch the relevant S curve(s) for your industry, technology, or product. 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?
- What are the principle drivers of industry, technology, or product evolution and market structure in your industry?
- What might be their technology strategy? How might you manage the technological innovation process?
- Do network externalities or standards play a role? Explain/discuss.
- What conclusion or recommendation you have for this industry / technology / product category?

COURSE MATERIALS

1. Case studies available at: <https://hbsp.harvard.edu/import/1131508>
2. Additional readings available on Canvas
3. Course Reference Textbook: Strategic Management of Technological Innovations, Melissa Schilling 7th Ed, 2022.

Cases

For this course you will present case analysis as a team of size 3-4 members. Even when working on case analyses in groups, it is important to read and do some analyses on your own before the meeting. It is also a good idea to have your own copies of cases.

PREPARING CASES FOR DISCUSSION

If you have done case analysis in other courses, you should not have trouble with the assignments in BIOE 574. To help you prepare, questions for all cases are available in the “**Case Question**” section of this document.

As mentioned earlier, our approach to cases is analytical and decision oriented, focused on being managerially relevant. Being **analytical** means that you systematically take the case situation apart, study its components, draw conclusions about those components or groups of components, and assemble those conclusions into an overall solution. As you engage in this process:

- Beware of brilliant flashes of intuitive genius. Although intuition can lead to creative or novel conclusions and solutions once in a while, most of the time it results in incomplete and underdeveloped solutions that are not well supported by case data.
- If you have an intuitive insight, write it down and then examine it systematically and carefully to ensure that it addresses the relevant factors, and that it is logically supported by case data. You need to be skeptical even of your own ideas.
- Look for evidence in the case to bolster your ideas and arguments. If you cannot find evidence you can still put your ideas forward but be sure to state that the ideas are intuitive, and don't be surprised if someone challenges you.

Decision-oriented means just that –you have to make a decision in each and every case. Your analysis should reveal what decisions need to be made (i.e., what are the central and attendant problems facing the company). It should also reveal alternative courses of action, and which course of action makes the most sense. Keep in mind that:

- No single course of action will be all good or all bad. All courses of action involve trade-offs. Consequently, you should note the strengths and weaknesses of each alternative.
- You must choose a course regardless of how difficult the choice may be. In some situations the criterion for taking action is “choose the lesser of all evils”, not “the path to greatest glory.” Project the expected outcomes from your chosen course of action, and explain why you chose it and why you rejected alternative courses. Your reasoning should be supported by case data, not mere intuition.

- You can make assumptions to supplement case data but be sure they are reasonable and that you identify them as assumptions assignments.

Your case analysis should be **managerially relevant** – leading to actionable recommendations.

- Your conclusions must provide concrete and specific guidance to management. Recommendations should go beyond generalities. Give specific recommendations, as specific as the data allow.
- You should evaluate your recommendations as harshly as possible. To evaluate your recommendations, step back and review them as if they had been presented to you by one of your subordinates. Ask yourself, “Does this action plan help me know what to do next to solve my problems, and is it presented and supported to inspire confidence?”

The approach to case analysis recommended by most business schools involves two reading and two thought periods, as follows:

Reading 1. Read the case for familiarity with the company and its products, industry, competitors, suppliers, company people, their objectives, and their perception of the problem.

- Make note of unusual elements in the industry or its products which could affect company operations.
- Identify the company’s objectives, goals, size, industry position, and competitive strengths and weaknesses at a general level.
- Keep in mind that the managers portrayed in the case may not understand the real core problem. In most cases, the core problem or problems are not stated explicitly.

Thought Period 1. Let the data (words and numbers) from the case percolate in your mind for a while, and then try to identify the core problem(s) from your list of potential problems. The core problem(s) is what must be solved first.

- One way to identify core problems is to ask, for each potential problem you have uncovered, “What causes this?” You will probably find many problems are caused by a few factors that are not caused by other factors. These basic causes or *antecedent factors* comprise the core problem.
- Problems can be externally generated (e.g., forces in the environment that prevent you from achieving your objectives), internally generated (e.g., new company objectives and/or resources not being available to meet company objectives), or a combination of externally and internally generated problems.

Reading 2. Scour the case data, both the text and the exhibits and tables.

- Categorize facts as you read through the case and analyze the available data, writing down insights as they emerge under category headers such as “technology platform,” “emerging technology,” “key products and technologies,” “risks,” etc. for example.
- Search for data that impinges on the core problem(s) you identified, keeping in mind that new facts may force you to redefine the problem(s).
- Do not overlook exhibits and footnotes. Analyze exhibit data. You will undoubtedly have to assemble information from several places in the case, and perform some calculations, to arrive at well supported and managerially relevant solutions.

- Don't give up if the information you need is not immediately and easily available. Sometimes you have to dig into the data (e.g., perform calculations).

Thought Period 2. Assemble your conclusions and prepare your memorandum.

For BIOE 574, it is important to choose cases that illustrate technology management principles clearly, and the cases we are using are among the best even if some of them are old. Please note that cases are not used to teach you about different industries. No single case will provide you with an in-depth understanding of an industry or even a company.

FORMATTING INSTRUCTIONS FOR WRITTEN ASSIGNMENTS

Throughout the semester you will complete four case-based presentations. Please see the course schedule at the end of the syllabus for the cases and dates involved. The topics and expected content vary as explained below, but the standards for writing style, formatting, and the level of specificity in descriptions and recommendations are the same for all the assignments. Please review the standards below before finalizing your written assignments during the semester.

1. A maximum of 10 slides
2. Use the comments or notes section to provide a brief synopsis for the bullet points on the slide.

CONTENT INSTRUCTIONS FOR CASE-BASED ASSIGNMENTS

A. Discussion of Recommendation(s)

Discuss in specific terms your proposed action and the benefits such action will bring to the organization. Specific means that you present your recommendations in precise enough terms for a manager to make a decision if the case situation were real. If your assignment is to choose from several alternatives, your summary should be something like "This is to propose that the company do blah, blah, blah (your suggested action). This will result in blah, blah, blah (the company-relevant outcomes valued by management, such as sales, profits, market share, scale/scope economies, new technology platform, leadership in industry, in-licensing critical technology,...)."

B. Rationale Behind Your Recommendations

Summarize the strategic, competitive, external, and internal factors behind your decision, giving a rationale for adopting your action plan and discarding alternative ones. Among the items that MAY enter your arguments are:

1. What is the core problem that the organizations is facing?
2. Strengths and weaknesses of the firm. Make sure you are building on strengths and offsetting weaknesses as much as possible.
3. Organizational constraints and characteristics. Sometimes you will wish to do something that cannot be done because of the company's culture or other characteristics. Be realistic in your recommendations. Be ready to compromise.

4. In many situations it will be important to anticipate competitive responses to the various alternatives and to choose the one that is most likely to help your company's competitive position.
5. Sustainable advantage. Keep in mind those things that make your company great and successful, and don't make recommendations that compromise your sources of sustainable advantage unless they are absolutely necessary.
6. Organizational objectives. You may be asked to develop solutions within the constraints of a far-reaching and broadly based corporate strategy. Compatibility with overarching company goals is important.
7. Constraints and Risk. What may be the risk associated with factors governing the numerous decisions.

C. Exhibits

Diagrams and flowcharts of action plans and financial analyses are prime candidates for exhibits. The key to deciding if exhibits are necessary is to picture a well-informed manager reviewing your presentations and trying to make sense of your recommendations.

CASE QUESTIONS

Amgen Inc., Pursuing Innovation and Imitation

1. What are the main factors that determine the profitability of competitors in
 - a. The R&D-based pharmaceutical business (whether small or large molecule)?
 - b. The small molecule generics business?
2. Why should Amgen even begin to think about participating in biosimilars?
3. How do you think different functions within Amgen view the possibility of participating in biosimilars?
4. What risks would Amgen face in entering the emerging biosimilars business? Staying out of the business? What are the upsides and downsides?
5. Would you advise Kevin Sharer to enter or stay out of biosimilars?

Anandam Manufacturing Company: Analysis of Financial Statements

1. What are challenges faced by the Indian textile market?
2. What are the key characteristics and drivers of growth in the textile industry in the Indian market?
3. What are the problems facing Anandam Manufacturing as it grows?
4. Calculate the following ratios:

• Current Ratio • Quick Ratio • Receivable Turnover Ratio • Receivable days • Inventory turnover ratio • Inventory days • Debt-to-equity ratio • Net margin ratio • Return on Equity • Return on Total Assets

5. How does Anandam Manufacturing financial position compare to the overall Industry?
6. Will you give Anandam the loan? Can you recommend any financial improvements?

Healthymagination at GE Healthcare Systems

1. What should Tom Gentile do? Should he give the green light or halt further commercialization of HepEcho? Teemax? UltraLipo? Omega? Use the criteria of product economics as well as healthymagination criteria of cost, quality, or access in the evaluation.
2. What are the primary areas of concern for each of the product concepts, using the Red-Yellow-Green(RYG) NPI evaluation Chart detailed in Exhibit 11? In your analysis, aggregate the four aspects of value creation and the four aspects of value delivery to create two RYG ratings for each product concept. What is the value in using this tool and process?

Dudley, Dentists and Design: A 3D Disruption Dilemma

1. What type of time horizon should John Frangella consider when forecasting segment developments: short, medium, or long term? Why?
2. What factors should be considered to forecasts the adoption rate for 3D printing within a segment?
3. How does forecasts of segment development impact strategic choice now?
4. How can the risks attached to the uncertainty of the forecasts be managed? Can a risk management tool be used for forecasted diversification?
5. What process would you recommend that John Frangella follow to make these product market decisions?

GRADING

Grade components will be weighed as follows:

- Case Presentations (4 @ 100pts) 400 points
- Team Project 110 points
- Exam 90 points

Final grades will be awarded based on the following scale:

A+, A, A- (outstanding)	= 540 to 600 points
B+, B, B- (very good)	= 480 to 539 points
C+, C, C- (OK)	= 420 to 479 points
D+, D, D- (needs help)	= 360 to 419 points
F	= less than 360 points

CLASS SCHEDULE

Class	Topic	Pre-Class Reading Assignment	Class Assignment	Assignment Due Date
WK-1 1/16 (T)	Course Overview and Introduction. Definition of innovation and technology. Importance of Technological Innovations.	<ul style="list-style-type: none"> • <i>The Discipline of Innovation</i> – Harvard Business Review, November-December, 1998, Drucker • <i>Innovation and growth: How business contributes to society</i>- Academy of Management Perspectives, 2010, Ahlstrom “ 		
WK-1 1/18 (R)	Creativity – Underlying process for innovation	<ul style="list-style-type: none"> • <i>3000 Raw Ideas Equals 1 Commercial success</i> – Research Technology Management, Vol. 40, no. 3, 1997, Stevens et al. 		
WK-2 1/23 (T)	Types and patterns of innovation. How industries evolve? Technology Adoption Profiles and characteristics	<ul style="list-style-type: none"> • <i>“Technological Discontinuities and Dominant Designs: A cyclical model of technological change</i> - Administrative Science Quarterly, Vol. 35, 1990, Anderson • <i>Innovation, competition, and industry structure</i> - Research Policy 22, 1993, Utterback 		
WK-2 1/25 (R)	Core competencies of a firm? What creates these competencies?	<ul style="list-style-type: none"> • <i>The Core Competence of the Corporation</i> – Harvard Business Review, 1990, Prahalad • <i>Core Capabilities and Core Rigidities: A paradox in managing new product development</i> – Strategic Management Journal, Vol. 13, 1992, Leonard-Barton 		
WK-3 1/30 (T)	Introduction to Strategy. What is strategy? Strategy and strategic intent. Resources and Capabilities	<ul style="list-style-type: none"> • <i>The Five Competitive Forces that Shape Strategy</i> – Harvard 		

		<p>Business Review, Jan 2008, Porter</p> <ul style="list-style-type: none"> • <i>How Competitive Forces Shape Strategy</i> – Harvard Business Review, Vol. 57, Issue 2, Mar/Apr, 1979, Porter 		
WK-3 2/1 (R)	Strategic Management & Implementation of Strategy	<ul style="list-style-type: none"> • <i>Dynamic Capabilities and Strategic Management</i> – Strategic Management Journal, Vol. 18, Issue 7, 1997, Teece 		
WK-4 2/6 (T)	Innovation and Imitation – Strategic Decisions	Case	Prepare: <i>Amgen Inc Pursuing Innovation and Imitation</i>	Case Summary Due – 8am
WK-4 2/8 (R)	Competing in Technology-Intensive Industries – Impact of tech standards and network effect and x-illities.	<ul style="list-style-type: none"> • <i>The Art of Standards Wars</i> – California Management Review, Vol. 41, No. 2, 1999, Shaprio 		
WK-5 2/13 (T)	<i>Timing of Entry</i>	Mini-case – Uber Elevate		
WK-5 2/15 (R)	Introduction to Financial Management			
WK-6 2/20 (T)	The Basics of Financial Statements			
WK-6 2/22 (R)	Financial Statement Analysis			
WK-7 2/27 (T)	Financial Statement Decision-Making Analysis	Case	Prepare: <i>Anandam Manufacturing</i>	Case Summary Due – 8am
WK-7 2/29 (R)	Financial Analysis of a Business Strategy			
WK-8 3/5 (T)	Choosing Innovation Projects	<ul style="list-style-type: none"> • <i>Structuring the new product development pipeline</i> – Management Science 48, 2002, Ding • <i>Analysis, ranking, and selection of R&D projects in a portfolio</i> – R&D Management 32, 2, 2002, Linton • <i>Customer power, strategic investment, and failure of leading firms</i> – Strategic Management 		

		Journal, March 1996, Vol 17, 3, Christensen		
WK-8 3/7 (R)	No Class -			
WK-9 3/12 (T)	<i>Spring Break</i>			
WK-9 3/14 (R)	<i>Spring Break</i>			
WK-10 3/19 (T)	Organizing for Innovation Managing NPD process and team	<ul style="list-style-type: none"> • <i>Ambidextrous Organization: Managing Evolutionary and Revolutionary Change</i> - California Management Review, 38, 4, 1996, Tushman • <i>The effect of team leader characteristics on learning, knowledge application, and performance of cross-function new product development teams</i> – Decision Sciences 34, 2003, Sarin 		
WK-10 3/21 (R)	Managing New Platform	Case	Prepare: <i>Healthymagination at GE Healthcare Systems</i>	Case Summary Due- 8am
WK-11 3/26 (T)	Organizational Change Management	Organizational Change Management		
WK-11 3/28 (R)	No Class -			
WK-12 4/2 (T)	Open Innovation	<i>Open Innovation: Where We've Been and Where We're Going</i> - Research Technology Management, 55, 4, 2012 Chesbrough		
WK-12 4/4 (R)	Profiting from Innovation – Corporations, Entrepreneurship	<ul style="list-style-type: none"> • Quad Charts • <i>First-Mover Advantages</i> – Strategic Management Journal, Vol. 9, 1988, Lieberman • <i>Profiting from Technological Innovation: Implications for integration, collaboration, licensing, and public policy</i> – 		

		Research Policy, Vol. 15, 1986, Teece <i>Moving Technologies from Lab to Market</i> - Research Technology Management, Nov.-Dec 2002, Markham.		
WK-13 4/9 (T)	Managing Intellectual Property and intellectual property rights from innovations	<ul style="list-style-type: none"> • <i>Technical Note: Intellectual Property</i> – The Ground Rules 		
WK-13 4/11 (R)	Intellectual Property Strategic Opportunity	<ul style="list-style-type: none"> • <i>“Intellectual Property and Strategy”</i>, HBS, David Yoffie 		
WK-14 4/16 (T)	<i>Intellectual Property Challenge</i>	Mini-case-The Patent Battle Over CRISPR		
WK-14 4/18 (R)	Managing Disruptive Technology	Case	Prepare: <i>Dudley, Dentists, and Design: A 3D Disruption Dilemma</i>	Case Summary Due- 8am
4/23 (T)	Exam Review			
4/25 (R)	<i>No Class</i>		Project Reports Due	Due - 11:59 PM
4/30 (T)	Exam	Open Notes		

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