MANAGEMENT 214: TECHNOLOGY INNOVATION AND STRATEGY
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COURSE DESCRIPTION

The course is designed to meet the needs of future managers, entrepreneurs, consultants and investors who must analyze and develop business strategies in technology-based industries. The emphasis is on learning conceptual models and frameworks to help navigate the complexity and dynamism in such industries. This is not a course in new product development or in using information technology to improve business processes and offerings. We will take a perspective of both established and emerging firms competing through technological innovations, and study the key strategic drivers of value creation and appropriation in the context of business ecosystems. Such a perspective will help answer the following questions:

- What are the theoretical models of industry, technology, and market evolution, and what are the implications for strategy?
- Why do established firms struggle to compete in a changing technology landscape, and what can they do to increase the odds of success?
- How can start-ups disrupt mature industries?
- How to create value in a platform-based ecosystem, and manage the shift from a product focused to a platform focused strategy?
- What are the different types of business models that firms can use to innovate and appropriate value from their technology IP, and how should firms choose which business model to use?

The course uses a combination of interactive lectures, case analyses and simulation. It draws on the rich and emerging stream of research in technology management and strategy that moves beyond "one size fits all" approach to technology firms and instead focuses on the choices that managers and entrepreneurs face in a specific strategic situation. Cases offer an opportunity to integrate and apply the theories and frameworks in a practical way, and are drawn from a diverse range of technology-based industries. Note, however, that case discussions are mainly based on strategic (not technical) issues. Hence, a technical background is not required for fruitful participation. In addition, guest speakers will be invited to share their perspectives on contemporary issues.

EVALUATION

Individual

Class participation including participation in online polling (35 points)
Back Bay Battery simulation write-up (10 points)
Case write-up (10 points)
Two reaction papers (10 points each)
Insights conference
    Proposal (5 points)
    Presentation (20 points)

CLASS PARTICIPATION

This is designed to be an interactive discussion-based course. Hence, class participation is a crucial component of not only the evaluation but also the learning in the course. It is expected that you are well-prepared for each class session. To help you prepare, discussion questions and online polls related to the specific cases and topics will be provided in advance. Everyone will be individually responsible for responding to the poll by **8 a.m. the day of class**. Answering the poll will not take much time beyond your normal preparation for the class. If you do not respond to the poll, I will assume that you have not prepared for the class. I may call upon you to discuss your answer in the poll.

In general, four factors determine high quality comments in the class. First, is a given comment clearly related to the case and/or topic being discussed? Second, does the comment move the class discussion forward? Third, does the comment reflect consistent and logical reasoning or are there gaps in the logic? Fourth, does the comment draw on specific facts from the case or readings or personal experience to support the assertion? Note that quality, not quantity, will determine the effectiveness of your comments. "Airtime hogs" will not be rewarded. For case analyses, it is helpful to identify the key choices facing the protagonists, to evaluate alternatives (including what additional information you might need to gather to make a clear decision), and to think about the course of action you would recommend and why.

Of course, the underlying condition for class participation is attendance. I expect you to attend all sessions and I will be taking attendance. Arriving late is disrespectful to your colleagues and, for attendance purposes, is treated as a distinct event from being present at the start of class. Note that unexcused absences and tardiness will adversely affect class participation marks. A maximum of three excused absences will be accepted. Please note that slides will be posted after each class in the course web site set up for this course.

BACK BAY BATTERY SIMULATION WRITE-UP

Firms face many challenges and tradeoffs with respect to their technology investment decisions. The case of Back Bay Battery will help us engage deeply with such challenges and tradeoffs in a real business situation. You will play the role of the President at Back Bay Battery Company, a manufacturer of nickel metal hydride (NiMH) batteries. The President's responsibility is to determine the appropriate timing and level of R&D investments between existing and new battery technologies under uncertain real-world conditions. Your decisions are of course subject to corporate-level financial constraints. You are required to play a single run of the simulation and submit the individual write-up on Canvas **by October 10**. You will play another slightly modified run in teams in class. Note that each run includes making decisions over an eight-year period. The write-up is meant to capture your thinking over the course of the simulation. It should be a maximum of two pages of text (12 pt. Times Roman font, single spaced, with margins no less than 1 inch), and an optional 1 page of exhibits. The write-up should address the following questions (either in a Q&A form or an essay form):

- What was the initial strategy and the logic underlying that strategy? Please be explicit about the assumptions that formed the basis for the initial strategy
- How did the strategy change over time (i.e., between the first and the eighth year), and what were the reasons for those changes?
- What were the main challenges that you faced while making decisions?
- What additional information you would have liked to have before making decisions? Please be explicit about how might that information be collected and how would it improve decision-making
- What did you take away from the simulation?

CASE WRITE-UP

To help you develop a richer perspective on the cases, you will work on an individual assignment of with one of the cases that we discuss in the class. You will also be the class participation "leader" for that case discussion. This provides an opportunity for each student to "stand out." A sign-up sheet to choose the case will be provided prior to the first day of class. The case write-up should be a maximum of 2 pages of text (12 pt. Times Roman font, single spaced, with margins no less than 1 inch). Additionally, you may attach 1 or 2

exhibits based on your analysis if they directly support your arguments/recommendations. The write-up is due **by the evening prior** to the day the case is discussed in class, and should be uploaded on Canvas. Strong write-ups will develop logical arguments using course concepts/frameworks and information from the case, and to the extent the case allows, validate arguments with quantitative information.

REACTION PAPERS

To help you develop expertise in technology analysis, you will work on two individual reaction papers during the course of the semester. Each reaction paper will analyze and interpret a relevant current event through the lens of the course. The current event could involve a technological change or a technological innovation by an established firm or a start-up that's in the news. Specifically, the reaction paper should analyze the event through the ideas covered in the course, and provide conclusions/recommendations with respect to the focal firms. In so doing, you could compare and contrast the insights (i.e., conclusions, recommendations) generated from your analysis with the views expressed in the business/trade media. Additionally, the reaction paper should also aspire to recognize opportunities for refinement and extension of the ideas covered in the course, which could also form a basis for subsequent class discussion. Here are some sources for identifying relevant current events:

- Fast Company
- MIT Technology Review
- The Verge
- Recode
- Technology Sections of BBC, Economist, WSJ
- Hacker News

Each reaction paper should be a maximum of 2 pages of text (12 pt. Times Roman font, single spaced, with margins no less than 1 inch). Additionally, you may attach 1 or 2 exhibits based on your analysis if they directly support your arguments/conclusions/recommendations.

The first reaction paper is due by **October 4** and the second reaction paper by **November 15** (you can of course submit them earlier depending on your workload over the course of the semester)

GRADING FOR INDIVIDUAL ASSIGNMENTS

The individual assignments will be evaluated in terms of "check," "check plus" and "check minus." You should interpret these as the following:

- Check (you have demonstrated a good understanding of the course concepts and frameworks, and how they are applied in analysis)
- Check plus (you have used the concepts and frameworks in the course in a precise and careful manner to generate outstanding theoretical/practical insights)
- Check minus (you have not yet fully demonstrated that you understand the frameworks and concepts from the course and how they are applied, and/or your write-up does not address all of the questions for the case or the Back Bay Battery simulation)

MANAGEMENT OF TECHNOLOGY "INSIGHTS CONFERENCE"

As the culmination of the course, we will draw on each other to explore the frontier of management of technology in an "insights conference." For this conference, you will work as a group (4-5 students from the same section) on one of the following topics:

- Compare two different technological innovations that were introduced in the same industry, one successful and the other unsuccessful, by two different firms (e.g., Nokia's vs. Apple's Smartphone; Sony's Betamax vs. JVC's VHS Video Cassette Recorder; MySpace vs. Facebook).

- Study the technological innovations of different players in an industry that is undergoing a significant technology discontinuity (e.g., Cloud-based Services, Electric or Autonomous Vehicles, Distributed Energy, Personalized Medicine, Internet of Things, Virtual Reality).

The topic should be well-researched, based on an extensive review of publicly-available information as well as specialized databases available through Penn Libraries. I strongly encourage you to attempt to gain access to the firms being studied to collect data and conduct interviews, since this can lead to a uniquely rich and insightful analysis.

Since teams often consider multiple proposals, each team should provide two different proposals preferably on different topics. These should be uploaded as a single document on Canvas by **November 4**. We will meet in the following week to discuss the proposals. For each of your two proposals, please write one paragraph explaining why you believe this is a suitable topic for the final presentation and then provide the following information:

- Brief synopsis of focal firm(s)
- Brief synopsis of focal technological innovations
- General list of sources of data that team expects to use (for private firms, please clearly identify at least one data source)

The presentations should last for **twelve minutes followed by seven minutes for Q&A**. It should provide a brief overview of the industry/technology but mostly focus on analysis, recommendations, and lessons learnt. All presentations should be uploaded on Canvas by **December 3**. You can include notes and appendix in the presentation to provide additional details underlying your analysis.

The presentation will be evaluated on three dimensions: First, the insight offered by the analysis – does it go beyond describing what happened to shed light on the fundamental causes of strategies/outcomes in a logically consistent manner. Second, the quality of the analysis and how well it integrates the concepts and frameworks discussed in the course. Third, how relevant, useful, and well supported are the lessons and recommendations presented. Each group member will be evaluated by all group members at the end of the semester. Evidence that group work has been unevenly completed will count against the grade for the insights conference.

As a general note, a litmus test for a strong analysis is a clear articulation and logic for the choices being made by the focal firm, the assumptions under which those choices make/made sense ex ante, and the root cause (the why of why!) of why they did/will (not) work(ed). Of course, all of this should be backed by data (quantitative and/or qualitative) and guided by the concepts and frameworks covered in the course.

NOTE ON CITATIONS

While you are probably aware of the conventions of properly citing material and ideas, I believe a short note on the subject is worthwhile. Material reproduced verbatim should be enclosed in quotation marks, with proper attribution made to the source. Ideas and concepts even if not quoted verbatim should be attributed to the author/source, also via proper citation.

FEEDBACK

I strongly encourage anyone with specific or general questions regarding the course structure, content or discussions to drop by my office (during office hours or by appointment) or to contact me via email or phone. There will be a detailed mid-course evaluation whose results I will present in class. If needed, we can also form a quality circle to anonymously gather additional feedback.

ETHICS

Below is the Ethics matrix for the course. Please go through it carefully and let me know if you have any questions.

	Materials							People				
MGMT 214 Technology Innovation and Strategy	Approved calculator	Laptop / other electronics	Summary sheet	Readings/ class notes	Past notes / summaries	Past exams / assignments	Internet content / other outside materials	Learning team / approved work team	Other student(s) in same section	Student(s) in other sections (same term)	Wharton student not taking the class this term	Person outside of Wharton
Readings & Cases	A	A	A	A				W	W	W		
Team Assignments	A	A	A	A			A	W				
Individual Assignments	A	A	A	A			A					
	A = Allowed material Blank Cell = Not allowed							W = Allowed to work together Blank Cell = Not allowed				

The information above covers many common situations but will not cover every circumstance. Remember:
The Wharton MBA Code of Ethics that you accepted requires, among other things, that you represent yourself and your work honestly, don't try to gain unfair advantage over other students, follow the instructor's guidelines and respect confidentiality of your work and the work of others.

COURSE OUTLINE*

08/30 Session 1 – Introduction; What is Technology Innovation and Strategy?

09/04 Labor Day (No Class)

Module 1 - Microfoundations

09/06 Session 2 – Industry Dynamics

1. Reading: Agarwal, R., & Tripsas, M. (2008). Technology and industry evolution. *The Handbook of Technology and Innovation Management*, *1*, 1-55 (Skim).

   Supplementary Reading: Kapoor, R. and Furr, N. (2015), "Complementarities and Competition: Unpacking the Drivers of Entrants' Technology Choices in the Solar Photovoltaic Industry," *Strategic Management Journal*, 36(3): 416-436.

09/11 Session 3 – Technology Dynamics

Readings: (1) Saffo, P. (2007), "Six Rules for Effective Forecasting," *Harvard Business Review*, 85(7/8):122-131; (2) Foster, R. (1986), "The S-curve: A New Forecasting Tool," Chapter 4 in *Innovation, The Attacker's Advantage*.

Supplementary Reading: Adner, R. and Kapoor, R. (2015), "Innovation Ecosystems and the Pace of Substitution: Re-examining Technology S-curves," *Strategic Management Journal*, 37(4): 625 – 648.

09/13 Session 4 – Market Dynamics

Readings: Moore, G. (1999), "High-tech Market Illusion" and "High-Tech Marketing Enlightenment," Chapters 1 and 2 in *Crossing the Chasm* (Skim).

Supplementary Readings: (1) Adner, R. and Kapoor (2010), "Value Creation in Innovation Ecosystems: How the Structure of Technological Interdependence Affects Firm Performance in New Technology Generations," *Strategic Management Journal*, 31(3): 306-333.; (2) Jackie Fenn (2014), "Applying Lessons From 20 Years of Hype Cycles to Your Own Innovation and Forecasting Strategies," Gartner. Inc.

09/18 Session 5 – HP Case Discussion

Case: Hewlett-Packard: The Flight of the Kittyhawk (HBS 9-606-088)

09/20 Session 6 – E Ink Case Discussion

Case: E Ink in 2005 (HBS 9-705-506)

Module 2 - Disruption

09/25 Session 7 – Technology Shifts

Readings: (1) McGahan, Anita (2004), "How Industries Change," *Harvard Business Review*, 82(10): 86-94; (2) Christensen, C. M., Raynor, M., & McDonald, R. (2015). What is Disruptive Innovation?. *Harvard Business Review*, 93(12), 44-53.

* The syllabus also includes supplementary readings. These readings provide a deeper treatment of the specific issues within a given topic. I will cover them in the class and while they are not expected to be read before the class, they may serve as useful post-class reference.

Supplementary Reading: Tushman, M., Smith, W., Wood, R., Westerman, G., & O'Reilly, C. (2010), "Organizational designs & innovation streams," *Industrial and Corporate Change*, 19(5): 1331-1366.

09/27 Session 8 – Kodak Case Discussion
Case: Kodak and the Digital Revolution (HBS 9-705-448)

10/02 Session 9 – E-Books Case Discussion
Case: E-Books in 2009: Did the Long Heralded Revolution Finally Arrive? (Wharton Case-48)

10/04 Session 10 – Netflix Case Discussion
Case: Netflix in 2011 (9-615-007)

10/09 Session 11 – Emerging Technologies: Trends, Opportunities and Challenges
Guest Speaker: TBD

Mid-term Capstone Exercise

10/11 Session 12 – Back Bay Battery In-class Simulation
Simulation: Back Bay Battery (HBS 7015-HTM-ENG)

10/16 Session 13 – Back Bay Battery Simulation Debrief

Module 3 - Platforms

10/18 Session 14 – Network Effects and Standards
Reading: Shapiro, C. and Varian, H. (1999), "Networks and Positive Feedback," Chapter 7 in *Information Rules: A Strategic Guide to the Network Economy*.

Supplementary Reading: (1) How to get to 30% share in 12 months (http://www.justice.gov/atr/cases/exhibits/684.pdf).

10/23 Session 15 – Network Effects Gamification

10/25 Session 16 – From Products to Platforms
Readings: (1) Van Alstyne, M.V., Parker, G. G., & Choudary, S. P. (2016). Pipelines, Platforms, and the New Rules of Strategy. Harvard Business Review, 94(4), 54-62.; (2) Parker, Geoffrey, and Van Alstyne, M.W. (2014), "*Platform Strategy Survey*,"Available at SSRN 2439323

Supplementary Reading: Kapoor, R. and Agarwal, S. (2016), "*Sustaining Superior Performance in Business Ecosystems: Evidence from Application Software Developers in the iOS and Android Smartphone Ecosystems*," Wharton School Working Paper

10/30 Session 17 – Apple and Google Case Discussion
Case Articles: Apple vs. Google – (1) iPhone Unveiled, AP, Jan 9, 2007 (2) Apple vs. Google, Businessweek, Jan 14, 2010; (3) Android Invasion, Newsweek, Oct 11, 2010; (4) Steve Jobs on Q4'2010 Earnings Call, Oct 18, 2010.

11/01 Session 18 – Intuit Case Discussion
Case: Intuit QuickBooks: From Product to Platform (HBS 9-714-433)

11/06 Session 19 – Discussion of Presentation Proposals

11/08 Session 20 – Discussion of Presentation Proposals

Module 4 – Technology IP Business Models

11/13 Session 21 – Capturing Value from Technology IP

Readings: (1) Teece, D. J. (2006). Reflections on "profiting from innovation". Research Policy, 35(8), 1131-1146; (2) Chesbrough, H. (2003), Chapter 9 in "*Open innovation: The new imperative for creating and profiting from technology*," Boston: Harvard Business School Press.

Supplementary Readings: (1) Cohen, W. M., Nelson, R. R., & Walsh, J. (2000), "*Protecting their intellectual assets: Appropriability conditions and why US manufacturing firms patent (or not)*," National Bureau of Economic Research Cambridge, Mass., USA; (2) Arora, A., Cohen, W. M., & Walsh, J. P. (2016). The acquisition and commercialization of invention in American manufacturing: Incidence and impact. *Research Policy*, *45*(6), 1113-1128.

11/15 Session 22 – Abgenix Case Discussion

Case: Abgenix and the XenoMouse (HBS 9-501-061)

11/20 Session 23 – Intel Case Discussion

Case: Intel Research (9-605-051)

Supplementary Readings: (1) Kapoor, R. and Klueter, T. (2015), "Decoding the Adaptability-Rigidity Puzzle: Evidence from Pharmaceutical Incumbents' Pursuit of Gene Therapy and Monoclonal Antibodies," *Academy of Management Journal;* (2) Kapoor, R. and McGrath, P. J. (2014), "Unmasking the Interplay between Technology Evolution and R&D Collaboration: Evidence from the Global Semiconductor Manufacturing Industry, 1990-2010," *Research Policy.*

11/27 Session 24 – Emerging Technologies: Trends, Opportunities and Challenges

Guest Speaker: TBD

11/29 Time for Research (No Class)

12/04 Session 25 – Insights Conference (Part 1)

12/06 Session 26 – Insights Conference (Part 2)

12/11 Session 27 – Course Wrap-up