MANAGEMENT 731: TECHNOLOGY STRATEGY*
FALL 2020

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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. Firms in such industries compete through technological innovations, and face significant uncertainty with respect to emerging technologies and business models. The emphasis in the course 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. The course will take a perspective of both established and emerging firms competing through technological innovations, and focus on the key strategic drivers of value creation and appropriation in the context of business ecosystems.

Some overarching questions that the course will help answer are:
- Why many promising technological innovations fail to create value, and what can firms do to manage the challenges of commercializing technological innovations?
- What are the different types of business models that firms can use to appropriate value from their technological innovations, and how should firms choose which business model to use?
- 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 technology start-ups disrupt mature industries?
- How to create value in a platform-based ecosystem, and manage the shift from a product-based to a platform-based technology strategy?

The virtual offering of this course uses a combination of pre-recorded lectures, live breakout sessions, discussions of specific cases and episodes of technology strategy, simulations, and interactions with invited guests. 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 and simulations will 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 and emerging technology trends. Class discussions are mainly based on strategic (not technical) issues. Hence, a technical background is not required for fruitful participation.

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* Updated August 20, 2020. Please note that this syllabus is subject to change with prior announcements.

EVALUATION

Individual
    Participation
        Attendance (15 points)
        In-session contribution (20 points)
        Pre-session poll assignments (10 points)
    Case write-up (7.5 points) due the day before the scheduled class for that case
    Back Bay Battery write-up (7.5 points) due on 11/01

Group[†]
    Strategic Analysis of Emerging Technology Trends and Businesses
    - Climate Change Analysis (5 points) due on 09/28
    - Urban Air Mobility Analysis (5 points) due on 10/05
    - Digital start-up Analysis (5 points) due on 10/12

    Strategy Analysis Project
    - Proposal (3 points) due on 11/15
    - Upload Analysis for Peer Group Feedback on 12/01
    - Peer Group Feedback (7 points) due on 12/02
    - Final Analysis (15 points) due on 12/06

Note: All deliverables and evaluation components are carefully structured to maximize the learning opportunities for the course participants and to ensure high quality in-class interactions, while attempting to keep the workload reasonable for a full credit course, uniformly distributed across participants and over time.

COURSE PARTICIPATION

This is designed to be an interactive discussion-based course. Hence, participation is a crucial component of not only the evaluation but more importantly 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 topics and cases will be provided in advance on the course website. Everyone will be individually responsible for responding to the poll. Answering the poll will not take much time beyond 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, three factors determine high quality contribution in the class. First, is a given comment clearly related to the case and/or topic being discussed? Second, does the comment help move the class discussion forward? Third, 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. You contribution score would be jointly determined by the faculty and by your peers in terms of your contribution to their learning.

Of course, the underlying condition for participation is being present throughout the live session. We are living in surreal times with many distractions and challenges but I hope that you would be able to attend all sessions. However, because of unforeseen circumstances, I will allow up to two unexcused absences, and these absences will not penalize your grade. Joining the live session late (more than 3 mins) or leaving early is

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[†]Students will work in different groups in order to enhance collaboration within the learning community. There will be a specific group for each of the analysis project.

disrespectful to your colleagues -- for attendance purposes and to be fair to your colleagues, it would be treated as a distinct event from being present throughout the session, and would carry an attendance penalty.

CASE WRITE-UP

To help you develop a richer perspective on the cases, you will work on an individual assignment of answering the study questions associated with one of the cases that we discuss in the class. The study questions are available on Canvas under the specific class session. You will also be the class "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 on the first day of class. The case write-up should be a maximum of 1,200 words 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. Please note that this assignment will not appear in the "To-Do" list because the due date is different for each case. It can be found at the bottom of the syllabus page, or with other "undated" assignments. 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.

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. You will play another slightly modified run in groups 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 1,200 words 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?

STRATEGIC ANALYSIS OF EMERGING TECHNOLOGY TRENDS AND BUSINESSES

A unique feature of this course would be to collaboratively engage with some of the emerging technology trends and businesses and to develop in-depth analytical skills, that are guided by management research and by domain experts. I have identified three distinct opportunities for this year, each operating at a different level of analysis. First, we will analyze the different technologies that have been identified as key to mitigating climate change. Second, we will analyze the nascent but emerging opportunities around urban air mobility (UAM). Finally, we will analyze early-stage digital startups in terms of the value proposition and the growth prospects. Students would collaborate in groups and work on their analysis during an in-class session. There will be a subsequent session to debrief on the analysis and to gain the perspective from invited experts.

STRATEGY ANALYSIS PROJECT

As the culmination of the course, we will draw on each other to explore the frontier of technology strategy by engaging deeply with current and emerging episodes of firms competing through their technological innovations. For this project, you will work in a group of 5 students from the same section. As part of the project, you would identify two firms, start-up or established, in the same industry domain pursuing different technology strategies, which are at the early stage of implementation (e.g., Tesla and Waymo on Autonomous Vehicles, Charles Schwab and Betterment on Robo-Advising, Facebook and Magic Leap on Virtual Reality). Your objective would be to:
- identify key differences in the strategies
- consider the assumptions behind those strategies
- undertake a systematic analysis and provide a conclusion in terms of which firm's strategy is likely to be more successful five years out
- provide recommendations to the firm whose strategy is deemed to be less successful five years out

The project should be well-researched, based on an extensive review of publicly-available information as well as specialized databases available through Penn Libraries. I 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.

Each group would first provide a 1-2 page proposal and an optional 1 page of exhibits that would be evaluated for fit and provided with initial feedback. The proposal should include the following information:
- Project motivation
- Brief synopsis of focal firms
- Brief synopsis of focal technological innovations
- General list of sources of data that the group expects to use (for private firms, please clearly identify at least one data source)

The analysis should be completed in the form of a slide deck with a maximum of 10 slides (excluding the title slide), and can include presentation notes for sharing additional details underlying the analysis.

Each group will be assigned to provide feedback on another group's analysis. The feedback should be provided in the form of a slide deck with three slides (excluding the title slide). The first slide would focus on the strengths of the analysis, the second slide would focus on the opportunities for clarification and improvements with the analysis, and the third slide would include a wishlist of what else could be considered to make the analysis more compelling and insightful.

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 sense, and the root cause (the why of why!) of why they will (not) work. 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.

Each group will have an opportunity to update the analysis based on the feedback received from the peer group, and present their analysis to the class.

GRADING SCHEMA FOR WRITE-UPS AND ANALYSIS

Because course deliverables (write-ups, analysis) are designed for the purpose of both facilitating and evaluating your learning and are not based on quantitative problem-solving, they will be evaluated through a simplified schema -- "check," "check plus" and "check minus." In general, you should interpret these as the following:

- Check ~ 80-85% points (you have answered all questions and/or addressed the key issues, and demonstrated a good understanding of the course concepts and frameworks)
- Check plus ~ 95-100% points (you have answered all questions and/or addressed the key issues, and have used the concepts and frameworks in the course in a precise and careful manner to generate outstanding theoretical/practical insights)
- Check minus ~ 65-70% points (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 or key issues)

For the strategy analysis project, 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 individual's score for the project.

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 would like to help in every way that I can to enhance your learning experience, and I am also always looking for ways to improve the course. Hence, I strongly encourage anyone with specific or general questions/suggestions regarding the course structure, content or discussions to reach out to me.

COURSE OUTLINE‡

09/02 Session 01 – Course Introduction

Fundamentals of Technology Development and Commercialization

09/09 Session 02 – Technology Development

09/14 Session 03 – Technology Adoption

09/16 Session 04 – Technology Ecosystem

09/21 Session 05 – Technology Business Model

09/23 Session 06 – E Ink Case Discussion

Strategic Analysis of Emerging Technology Trends and Businesses

09/28 Session 07 – Climate Change (In-class Group Work)

09/30 Session 08 – Climate Change (Debrief and Expert Perspective)

10/05 Session 09 – Urban Air Mobility (In-class Group Work)

10/07 Session 10 – Urban Air Mobility (Debrief and Expert Perspective)

10/14 Session 11 – Digital Start-ups (In-class Group Work)

10/16 Session 12 – Digital Start-ups (Debrief and Expert Perspective)

Strategic Management of Disruption

10/19 Session 13 – Research Evidence and Frameworks

10/21 Session 14 – Kodak Case Discussion

10/26 Session 15 – Microsoft Case Discussion

10/28 Session 16 – Netflix Case Discussion

11/02 Session 17 – Back Bay Battery Simulation (In-class Group Work)

11/04 Session 18 – Back Bay Battery Simulation (Debrief)

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‡ The primary readings, videos and assignments for each class session would be available on the course website at least two weeks before the class session. To enhance opportunities for learning and collaboration in a virtual environment, several sessions will entail in-class group work, facilitated by me and the Teaching Assistant.

Platforms

11/09 Session 19 – From Products to Platforms

11/11 Session 20 – Platform Strategy Simulation (In-class Group Work)

11/16 Session 21 – Platform Strategy Simulation (Debrief)

11/18 Session 22 – Apple and Google Case Discussion

Strategy Analysis Project

11/23 Session 23 – No Live Session (Time for Research)

11/30 Session 24 – Finalize Analysis (In-class Group Work)

12/02 Session 25 – Peer Review (In-class Group Work)

12/07 Session 26 – Presentations

12/09 Session 27 – Presentations and Course Wrap-up