

Columbia University
School of Engineering and Applied Science
Department of Industrial Engineering and Operations Research

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Managing Technological Innovation

Introduction

This course provides an introduction to and overview of technological innovation in small, fast-growing enterprises. We will explore both the theories of innovation as well as the strategic and tactical approaches and processes that these theories entail. We will discuss, both amongst ourselves and with speakers from startups, venture capital firms, and established companies, the practical realities of implementing these approaches and processes in today's entrepreneurial environment.

Course Requirements

The final grade for the course will be a weighted average of your grades on two group project papers, an individual paper, in-class participation, and homework.

Group Project

You will form a group of three or four people from the class. The group will choose an idea for a startup business and will use the strategies and processes we learn to explicate this business opportunity. There will be two group papers submitted, one on 11/4, and one on 12/9.

Individual Paper

You will critique the business plan of a startup company (list of companies to be provided towards the end of the semester) using the ideas, tools, and techniques taught in this class. This paper will be an individual effort and will be due 12/16.

In-class participation

You are expected to read regularly the assigned material before each lecture and participate in the general discussion during the lecture. Participation in case-study discussions and in-class group assignments is critical to the learning process. We will pass out cards for you to write your names on in the second class. Bring these with you so we know your name when you participate.

Because of the importance of participation and the interactive nature of most of the class, we ask that you close all laptops and refrain from using your phones. Class slides will be posted after every lecture, so taking notes may not be necessary (but is up to you.)

Homework

There will be written assignments to be handed in for about half the classes. These will typically be short and are meant to familiarize you with the problems to be discussed in the next class. As such, they will be graded with a check, a check minus, or 'not handed in.'

Homework should be handed to the TA **on paper, in class, by you**. There will be no credit otherwise unless you have emailed about not attending that class.

Attendance

Attendance is mandatory. Our teaching method is interactive, if you don't come to class, you don't learn. If you can't make it and have a good reason, email me and the TA. If there is an assignment due that day, attach it to the email. If you need to miss more than a couple of the 13 class sessions, please talk to me.

Everything you hand in should have your uni and name on it. Group and individual papers emailed to me should also copy the TA and must be in PDF format. Homework may not generally be emailed. Each file emailed should have a filename that start with your uni and then says what it is. If you have to resend a second file to replace the first, mark it in the filename with 'v2'.

Readings

The textbooks for the class will be:

1. Aulet, Bill, **Disciplined Entrepreneurship: 24 Steps to a Successful Startup**, Wiley, 1st edition (August 12, 2013).
2. Osterwalder, Alexander, and Yves Pigneur, **Business Model Generation**, John Wiley and Sons; 1st edition (July 13, 2010).
3. Fitzpatrick, Rob, **The mom test : how to talk to customers & learn if your business is a good idea when everyone is lying to you**, CreateSpace Independent Publishing Platform; 1 edition (September 10, 2013).

There will be several handouts and case-studies distributed through courseworks. There will also be several case-studies you will need to buy through the Harvard Business School site, use this link to find the coursepack: <http://cb.hbsp.harvard.edu/cbmp/access/51452002>. In addition, there will be readings assigned for each class, along with URLs to access them.

The readings do not generally duplicate what we say in class. Because we are teaching in large part through case studies, we need you to do the readings so you can participate in a meaningful way. The readings provide you with the tools to do the analyses we will work through in the class case-studies.

Grading

Group paper I	25%
Group paper II	25%
Individual paper	25%
Participation	10%
Homeworks	15%

Note

This class is unlike most engineering classes: we are teaching a way of engaging with society across a broad range of poorly-specified problems. As such, the ability to communicate is important, both in writing and verbally. Real-world data, analysis of extant data, and expert third-party opinions are convincing, your personal opinion less so, unless you happen to be an expert on the issue being discussed. For clarity and conciseness, we prefer a writing style that is heavier on bullet points, charts and other graphical demonstrations, and analytical argument, not the essay-style writing generally taught in high-school.

Group projects, aside from the task of actually writing a paper, have the additional challenge of managing group dynamics. But this challenge is the same one you will face at any startup. We expect you to manage this internal to your group. If you cannot manage it, please talk to one of us.

Schedule of Meetings, Readings, and Assignments

Part 0: Introduction to MTI

- 9/9
- Technology, innovation
 - Entrepreneurship, startups
 - Innovation and economic growth
 - Class overview

Part I: Innovation & Evolution

- 9/16
1. Stages of new technology introduction
 2. What determines the pace and direction of innovation?
 3. Innovation at the firm level
 4. The competitive environment & startup goals

Readings for this class:

- iTunes case, in Files & Resources
- Christensen "The Evolution of Innovation" In *Technology Management Handbook*, edited by Richard Dorf. Boca Raton, FL: CRC Press, 1998. <http://www.eee.ufg.br/~lguedes/moodle/get/2.pdf>
- Christensen, Clayton M., "Disruptive Innovation". In: Soegaard, Mads and Dam, Rikke Friis (eds.). *The Encyclopedia of Human-Computer Interaction, 2nd Ed.* http://www.interaction-design.org/encyclopedia/disruptive_innovation.html
- Perez, "Technological revolutions and techno-economic paradigms", <http://cje.oxfordjournals.org/content/34/1/185> (Need to be logged in to the Columbia library site; if you can't make this link work, search the paper title at library.columbia.edu, CLIO, to find it.)
- Teece, David, "Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy", *Research Policy*, Volume 15, Issue 6, December 1986, Pages 285–305. (Can be found through CLIO.)
- Utterback, J.M, F.F. Suarez, "Dominant designs and the survival of firms", *Strategic management journal*, Volume 16, Issue 6, September 1995, Pages 415-430. (Can be found through CLIO.)

Optional, my take on a couple of these:

- "Who Profits from Innovation?", <http://reactionwheel.net/2014/09/whoprofits.html>
- "The Deployment Age", <http://reactionwheel.net/2015/10/the-deployment-age.html>

Assignment:

- Answer one of the case questions and hand it in to the TA in class.
- Group for group project picked (not graded)

Part II: Opportunity Generation and Assessment

9/23 Opportunity Generation

Readings for this Class:

- Balaji Srinivasan, "Market Research Wireframing and Design", https://spark-public.s3.amazonaws.com/startup/lecture_slides/lecture5-market-wireframing-design.pdf
- Porter, Michael, "What is Strategy?", (Available through CLIO, or Google it.)
- Chan, Kim, and Renée Mauborgne. "Blue Ocean Strategy: FROM THEORY TO PRACTICE." *California Management Review* 47.3 (2005): 105-121. (Available through CLIO.)

Assignment:

Industry for group project picked (not graded)

9/30 Opportunity Assessment

Readings for this class:

- Case study
- Porter, Michael, "The Five Competitive Forces That Shape Strategy", *Harvard Business Review*, 2008. Available through CLIO: <http://ezproxy.cul.columbia.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=28000138&site=ehost-live&scope=site>
- Blank, Steve, "Market Size Hypothesis" (pdf), <http://ultralightstartups.com/wp-content/uploads/2012/04/Steve-Blank-Market-Sizing.pdf>
- Gentschev, Greg, "A Full Market Sizing Example", <http://www.brekiri.com/blog/193/a-full-market-sizing-example/>
- Mike Preuss, "Modeling Total Addressable Market", <https://visible.vc/blog/modeling-total-addressable-market/>

Assignment:

Answer one of the case questions and hand it in to the TA in class

10/7 Business Models

Readings for this class:

Osterwalder, pp. 14-119 and pp. 200-239

No Assignment

10/14 Guest Lecture: How to Think

Readings for this class:

- [http://web.mit.edu/jsterman/www/All_Models_Are_Wrong_\(SDR\).pdf](http://web.mit.edu/jsterman/www/All_Models_Are_Wrong_(SDR).pdf)
- <https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/psychology-of-intelligence-analysis/index.html> (Part I only)
- <http://www.ascd.org/publications/books/108008/chapters/describing-the-habits-of-mind.aspx>
- <http://www.newyorker.com/magazine/2005/12/05/everybodys-an-expert>

No Assignment

10/21 Determining Financial Feasibility

Readings for this class:

- Read Aulet, Disciplined Entrepreneurship, Steps 15-19.
- Read the PDF "Lifetime Value", in the Files section.

No Assignment

10/28 Financial Modeling

Readings for this class:

- Read Aulet, Disciplined Entrepreneurship, Steps 1-4, 11, 14.
- Read the Circle Lending case, from the HBS website

Assignment:

Answer one of the case questions and hand it in to the TA in class

Part III: De-Risking

- 11/4
- De-risking overview
 - Lean
 - Customer Development

Readings for this class:

Fitz, **The mom test**

Assignment:

Group Paper I due

11/11 Zipcar case

Readings for this class:

Read the Zipcar case, from the HBS website

Assignment:

Answer one of the case questions and hand it in to the TA in class

Part IV: Managing Growth

11/18 Product Management

Readings for this class:

- Bussgang, J. et al, "The Product Manager", in HBS coursepack (<http://cb.hbsp.harvard.edu/cbmp/access/47895945>)
- Aulet, Disciplined Entrepreneurship, Steps 5-8, 23, 24
- Re-read/flip through: Balaji Srinivasan, Market Research Wireframing and Design https://spark-public.s3.amazonaws.com/startup/lecture_slides/lecture5-market-wireframing-design.pdf

No Assignment

12/2 Dropbox case

Readings for this class:

Read the Dropbox case, from the HBS website

Assignment:

Answer one of the case questions and hand it in to the TA in class

12/9 Funding the Business

Readings for this class:

- <https://hbr.org/1998/11/how-venture-capital-works>
- Dotzler, F., "[What Do Venture Capitalists do?](http://www.denovovc.com/articles/2001_Dotzler.pdf)" http://www.denovovc.com/articles/2001_Dotzler.pdf
- Explanation of corporate structure and equity, to be distributed

Assignment:

Group Paper II due

12/16 No Class!

Assignment:
Individual Paper due