

TECHNOLOGY STRATEGY

Fall 2008-2009

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This course provides a series of strategic frameworks for managing high-technology businesses. The emphasis throughout is on the development and application of conceptual models which clarify the interactions between competition, patterns of technological and market change, and the structure and development of organizational capabilities. The course is only offered in the Fall of 2008-2009.

This is not a course in how to manage product or process development. The main focus is on the acquisition of a set of powerful analytical tools which are critical for the development of a technology strategy as an integral part of business strategy. These tools can provide the framework for deciding which technologies to invest in, how to structure those investments and how to anticipate and respond to the behavior of competitors, suppliers, and customers. The course should be of particular interest to those interested in managing a business for which technology is likely to play a major role, and to those interested in consulting or venture capital.

The course utilizes lectures, case analyses, simulations and independent reading. The readings are drawn from economics, and from research in technological change and organizational theory. The case studies provide an extensive opportunity to integrate and apply these abstract tools in a practical, business policy context.

Grades will be determined by class participation, four two-page papers, and a final paper based on a group project. The group project – which may be written in groups of 3 people – consists of an in-depth exploration of technology strategy in an industry of your choice. Many students chose to focus their two page papers and final paper on the same topic and, thus, “build up” to the final paper due at the end of the semester. There is no final exam.

This is an advanced course. I draw extensively on the material presented in 15.900, Strategic Management, 15.011, Introduction to Economics. Knowledge or work experience of basic concepts in innovation and entrepreneurship in high technology settings is also useful for background to this course. 15.900 and 15.011 are suggested pre-requisites. Students who have not taken these courses can still bid and register for the course, but should please contact me to let me know. I can provide supplemental readings if needed or desired.

As markets become more interdependent and dynamic, partnerships between firms have become a critical aspect of technology strategy. Therefore, another important theme of the course content is how high technology firms create, capture, and deliver value through inter-firm relationships such as alliances, collaborations, corporate venture capital, and joint ventures.

COURSE REQUIREMENTS AND EXPECTATIONS

Grading

| | |
|------------------------------------|-----|
| Class attendance and participation | 50% |
| Four two-page papers | 20% |
| Final paper | 30% |

Class Attendance and Participation:

Most of your participation grade will be based on attending class on time and adding value during the case discussions.

Four Two-Page Papers:

Your class performance will also depend upon four short two-page papers which will be done throughout the semester. Topics are below. Details about precise due dates will follow.

Topic:

Sketch the relevant S curve(s) for your industry. 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 evolution and market structure in your industry?

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? Will this change in the future?

Where is most of the value captured in your industry? Why? Do standards play a role? What influence do different firms have over the evolution of technologies?

Final Paper and Class Presentation

The final paper should illustrate the application of one or more of the frameworks developed in the class to an industry or firm of your choice. Please note you do not have to do this final project (paper + presentation) with the same people (or about the same industry) with whom you wrote your “2 pagers”, although many groups in the past have found this to be an effective strategy to gradually build up their knowledge about a firm or industry of interest over the semester. My goal is to support you in writing about a topic that interests you. More details about this final paper will follow in the first week of the class.

Previous titles have included:

The future of fuel cells -- What happened to GO?-- Structuring Corporate Research at Otis Elevator -- Seiko-Epson's Message Watch in the Taiwan Market -- Red Hat and Linux: The battle for a standard – Sony vs Microsoft in the video game market – The future of Nanotechnology

Collaboration

Group work is not only acceptable but actively encouraged. Indeed *I would strongly recommend that you form a study group* with a few friends who can meet to discuss the readings before each class. My experience suggests that this will significantly increase both your enjoyment of the course and the amount that you find yourself learning.

Reading Packets & the Web

Teaching notes will be available on the course web site, while other assigned readings are available from Graphic Arts, with the exception of those cases which are noted in the syllabus as being distributed in class. When you pick up your course packet, please check to be sure that it is complete. The transparencies from each lecture, links to points of interest (e.g., company web sites) and critical course information such as due dates will also be posted on the web.

Supplementary Reading

Supplementary readings are used to illustrate key concepts in each section of the course. Some of these concepts may be familiar to those who have taken 15.350/15.351 “Managing Technological Innovation and Entrepreneurship”. If you have not taken either 15.350 or 15.351, and if you are otherwise unfamiliar with the following concepts:

The S curve & the determinants of industry evolution
Tools for exploring new markets: The nature of the innovator’s dilemma
Capturing value: Uniqueness & complementary assets
Core concepts in network externalities
Why responding to discontinuous technological change is so difficult and what to do about it

...then you may wish to read ahead in the papers that follow (which are all in the course reader).

The S curve & the determinants of industry evolution

Anita McGahan: “How Industries Change”, Harvard Business Review, 2004.

Foster, R. (1986). "The S-curve: A New Forecasting Tool." Chapter 4 in Innovation, The Attacker's Advantage, Summit Books, Simon and Schuster, New York (NY). pp. 88-111.

Utterback, James “Invasion of a Stable Business by Radical Innovation,” Chapter 7 in *Mastering the Dynamics of Innovation*, (MA: Harvard Business School Press, 1994).

Tools for exploring new markets: The nature of the innovator's dilemma

Moore, G. *Crossing the Chasm*. Rev. Ed., (NY: Harper Collins, 1999), pp 9-62. Chapter 1 "High-Tech Marketing Illusion" and Chapter 2 "High-Tech Marketing Enlightenment"

Christensen, Clayton "How can great firms fail? Insights from the hard disk industry" Chapter 1 in *The Innovator's Dilemma*, Harvard Business School Press, 1997, pp 3-28.

Capturing value: Uniqueness & complementary assets

Henderson, Rebecca "Making Money from Innovation" Chapter 3 from Strategy and Technology

Network externalities

Shapiro, Carl and Hal Varian, "The Art of Standards Wars," California Management Review, Volume 41, No. 2, Winter 1999

Brandenburger, Adam, and Barry Nalebuff, Co-opetition, Ch 1 "War and Peace" ch 2 "Co-opetition" ch 5 "added value" New York, Doubleday, 1996, pp 3-39, 110-158

Why responding to discontinuous technological change is so difficult and what can be done about it

Tushman, Michael and Wendy Smith "Technological Change, Ambidextrous Organizations and Organizational Evolution." In J. Baum (ed) Companion to Organizations, Blackwell, 2001.

Henderson, Rebecca "Going for Growth: Managing Discontinuous Innovation Chapter 7 from Strategy and Technology (forthcoming)

Course Outline

0. Introduction

Creating, Capturing, and Delivering Value with Technology Strategy

I. Creating Value: Technology, Market, and Organizational Perspectives

Case: eInk

Case: Apple 2006

Industry Life Cycles and Evolution of Markets; Case: Novartis

Partnership Case: Intel (A): Photolithography Strategy in Crisis

Organization of Innovation: Structure, Processes and Incentives

II. Capturing Value: Appropriability, Competition, and Interdependence

Case: Abgenix and the Xenomouse

Appropriability: Uniqueness and Complementary Assets

Case: Ember: Developing the Next Ubiquitous Network Standard

Open Standards, Increasing Returns, and Proprietary Control

Case: Red Hat and the Linux Revolution

Partnership Case: Google & AOL

Ecosystems, Platforms and the Evolution of Value Chains

Case: Nokia; Apple iPhone & Google Phone

Competing up and down the Value Chain

III. Delivering Value: Organizational Dynamics and Inter-Firm Relationships

Case: We've got Rhythm! Medtronic Corporation's Cardiac Pacemaker Business

Case: Toyota Motor Corporation: Launching Prius

Organizational Dynamics: Overload, Time-Pacing, Simple Rules, and Probing

Partnership Case: Alza/Ciba (1): Structuring a Deal?

Partnership Case: Alza/Ciba (2): Managing the Relationship, 1977-1979

IV. Practicing Technology Strategy

Case: Kodak and the Digital Revolution (A)

Selected Student Presentations

Conclusions and Reflections

TECHNOLOGY STRATEGY
PROF. JASON DAVIS
FALL 2008

0. INTRODUCTION:

Class 1: Introduction: Defining “Technology Strategy”

“The Way of the Warrior,” The Economist, 2004

Questions for Discussion

Is the strategy outlined for Motorola *useful*? Why or why not? In your view, how should one define a strategy for a technology driven company? How should such a strategy differ from a technology strategy? What should be the relationship between them? When is a technology strategy useful? What should be its role?

I. CREATING VALUE: TECHNOLOGY, MARKET, AND ORGANIZATIONAL PERSPECTIVES

Class 2: eInk: Financing Growth

Questions for Discussion

What are the critical characteristics of electrophoretic displays? What implications do these characteristics have for systems of which they are a component?

Which possible applications should eInk be targeting?

How should eInk prioritize its opportunities? Should they target a smaller niche initially?

Which capabilities should eInk build?

Suggested pre-readings

The S curve & the determinants of industry evolution

Anita McGahan: “How Industries Change”, Harvard Business Review, 2004.

Foster, R. (1986). “The S-curve: A New Forecasting Tool.” Chapter 4 in Innovation, The Attacker's Advantage, Summit Books, Simon and Schuster, New York (NY). pp. 88-111.

Utterback, James “Invasion of a Stable Business by Radical Innovation,” Chapter 7 in *Mastering the Dynamics of Innovation*, (MA: Harvard Business School Press, 1994).

Class 3: Apple, 2006

Questions for Discussion

What are the critical technological trajectories in the personal computer industry over the last 20 years?

Who are the relevant customers and how have their preferences evolved over the last 20 years?

How has Apple’s PC strategy evolved? What technology trajectories do they emphasize? What customers do they target? What capabilities have they built over time? How do these capabilities differentiate their offering?

How has Apple's iPod and iTunes strategy evolved? What technology trajectories are emphasized? What customers do they target? What capabilities have they built over time? How do these capabilities differentiate their offering?

How does the iPhone fit into the iPod/iTunes strategy? How do technologies and customers differ for this product?

What is your recommended next step for the iPod/iTunes business?

Suggested Pre-readings

Moore, G. *Crossing the Chasm*. Rev. Ed., (NY: Harper Collins, 1999), pp 9-62. Chapter 1 "High-Tech Marketing Illusion"& Chapter 2 "High-Tech Marketing Enlightenment"

Christensen, Clayton "How can great firms fail? Insights from the hard disk industry" Chapter 1 in *The Innovator's Dilemma*, Harvard Business School Press, 1997, pp 3-28.

Class 4: Industry Life Cycles and Evolution of Markets

Questions for Discussion

Bring your questions and/or reflections on the content so far to class.

Note: Class 4 & Class 5 are combined on Feb 14th due to MIT Sloan Presidents Day Scheduling

Class 5: Novartis Pharma: The Business Unit Model

Questions for Discussion

How have innovations traditionally been developed at Novartis? How has this changed over time?

What role do biotechnology firms play in the Novartis innovation process?

What are the advantages and disadvantages of centralized R&D?

What other important issues are relevant to the design of Novartis's organizational structures?

How should Novartis restructure now?

Suggested Pre-readings

Tushman, Michael and Wendy Smith "Technological Change, Ambidextrous Organizations and Organizational Evolution." In J. Baum (ed) *Companion to Organizations*, Blackwell, 2001.

Eisenhardt, Kathleen and Charles Galunic, 2000, "Coevolving: At Last, a Way to Make Synergies Work" Harvard Business Review.

Class 6: Intel Labs (A) Photolithography Strategy in Crisis

Questions for Discussion

What is Intel's view of basic research?

What are the strengths of Intel's approach to R&D? Do you see any weaknesses?

What would you recommend that Sandy Wilson do? Of the three options outlined on page 10 of the case, which do you think makes the most sense and why?

Suggested Pre-readings

Eisenhardt, Kathleen and Shona Brown, 1999, "Patching: Restitching Business Portfolios." Harvard

Business Review: 73-82.

Henderson, Rebecca “Going for Growth: Managing Discontinuous Innovation Chapter 7 from Strategy and Technology (forthcoming)

Class 7: Organization of Innovation: Structure, Processes, and Incentives

No required reading!

Bring your questions and/or reflections on the content so far to class.

II. CAPTURING VALUE: APPROPRIABILITY, COMPETITION, AND INTERDEPENDENCE

Class 8: Case: Abgenix and the Xeno Mouse

Questions for Discussion

How do you think Abgenix can best exploit the Xeno Mouse? What should they do now?

Who else could capture value from the Xeno Mouse?

Suggested pre-readings

Henderson, Rebecca “Making Money from Innovation” Chapter 3 from Strategy and Technology (forthcoming)

Class 9: Appropriability: Uniqueness and Complementary Assets

No required reading!

Bring your questions and/or reflections on the content so far to class.

Class 10: Case: Ember Corporation: Developing the Next Ubiquitous Network Standard

Questions for Discussion

Should Ember integrate into chip manufacturing? Why or why not?

What are Ember’s major competitive threats going forward?

What should Ember’s strategy be?

Suggested pre-reading:

Shapiro, Carl and Hal Varian, “The Art of Standards Wars,” California Management Review, Volume 41, No. 2, Winter 1999

Arthur, Brian, 1996, “Increasing Returns and the New World of Business” Harvard Business Review, 74(4): 100-111.

Class 11: Open Standards, Increasing Returns, and Proprietary Control

No required reading!

Bring your questions and/or reflections on the content so far to class.

Class 12: Red Hat and the Linux Revolution

Questions for Discussion

What are the major advantages of Linux over other operating systems? What role do standards play?
What is Red Hat's strategy for creating and capturing value? What role do partnerships play?
What should Red Hat do now?

Suggested pre-reading:

Henderson, Rebecca and Kim Clark, 1990. "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms," Administrative Science Quarterly, Volume 35: 9-30.

Class 13: Google Inc.

Questions for Discussion

What value does Google create for users? How does Google capture value?
What are the major turning points in Google's evolution?
What role do partnerships play? What effect did Google's early partnerships (e.g., AOL) have on Google's evolution?
Who are Google's major competitors in every stage of its evolution? What are the major threats to Google's dominance in internet advertising?
What are Google's main competencies? Where does Google fit in the value chain?
What are the most important markets that Google should enter? Why?

Suggested pre-reading:

Brown, Shona and Eisenhardt, Kathleen, 1997, "The Art of Continuous Change: Linking Complexity Theory and Time-paced Evolution in Relentlessly Shifting Organizations." Administrative Science Quarterly, 42: 1-34.

Class 14: Ecosystems, Platforms, and the Evolution of Value Chains

No required reading!
Bring your questions and/or reflections on the content so far to class.

Class 15: Nokia 2003; Apple iPhone; Google Phone

Today's class will focus on a comparison of the mobile phone technology strategies of Nokia, Apple, and Google. Some reading materials will be handed out in class 14.

Questions for Discussion

What are the critical technology trajectories and customer segments impacting the next generation mobile phone industry?
What types of firms influence mobile technology standards and the adoption of technologies?
Compare Nokia, Apple, and Google mobile phone products and technologies. What differential value do they offer? What customers do they target?

Compare Nokia, Apple, and Google mobility value creation strategies. How do they fit with other lines of business?

Compare Nokia, Apple, and Google mobility value capture strategies. What role do uniqueness and complementary assets play?

How do the firm's capabilities differ? Compare the partnerships of each firm and describe their positions in the value chain.

What should each firm do?

Who will win the battle? Who will be most successful? Why?

Suggested pre-reading:

Brandenburger, Adam, and Barry Nalebuff, Co-opetition, Ch 1 "War and Peace" ch 2 "Co-opetition" ch 5 "added value" New York, Doubleday, 1996, pp 3-39, 110-158

Class 16: Competing up and down the Value Chain

No required reading!

Bring your questions and/or reflections on the content so far to class.

III. DELIVERING VALUE: ORGANIZATIONAL DYNAMICS AND INTER-FIRM RELATIONSHIPS

Class 17: We've got Rhythm! Medtronic Corporation's Cardiac Pacemaker

Questions for Discussion

Why did things go so badly wrong at Medtronic?

What role does rhythm play in Medtronic's line of business? What simple rules guide strategic decision making at Medtronic?

Of all the things that Medtronic did to "fix" its process, what do you think was the most important? Why?

What should they do now?

Suggested pre-reading:

Repenning, Nelson and John Sterman, 2001 "Nobody Ever Gets Credit for Fixing Problems that Never Happened" California Management Review, Vol 43 No 4.

Eisenhardt, Kathleen and Don Sull, 2001 "Strategy as Simple Rules." Harvard Business Review, 79: 107-116.

Eisenhardt, Kathleen and Shona Brown, 1998 "Time Pacing: Competing in markets that won't stand still." Harvard Business Review, 76: 59-69.

Class 18: Toyota Motor Corporation: Launching Prius

Questions for Discussion

What capabilities and technologies does Toyota possess related to hybrid technologies? What value does a hybrid car provide?

What are the critical decisions to be made? How should Toyota's executives make these decisions?

Should Toyota launch the Prius at this time or not? Why now? Why not wait?

Suggested pre-reading:

Eisenhardt, Kathleen, Kahwajy, Jean, and L.J. Bourgeois III, 1997. "How Management Teams Can Have a Good Fight." Harvard Business Review 76:2, 77-85.

Eisenhardt, Kathleen, 1989, "Making Fast Strategic Decisions in High-Velocity Environments." Academy of Management Journal, 32: 543-576.

Class 19: Organizational Dynamics: Overload, Time-Pacing, Simple Rules, and Probing

No required reading!

Bring your questions and/or reflections on the content so far to class.

Class 20: Case: Alza/Ciba (1)

Class 20 and 21 focus on a class-based exercise. Details will be provided in Class 19.

Suggested pre-reading:

Hamel, Gary, Doz, Yves L., C.K. Prahalad, 1989, "Collaborate with Your Competitors – and Win," Harvard Business Review.

Class 21: Case: Alza/Ciba (2)

Class 20 and 21 focus on a class-based exercise. Details will be provided in Class 19.

IV. PRACTICING TECHNOLOGY STRATEGY

Class 22: Kodak & the Digital Revolution (A)

Questions for Discussion

All things considered, did it make sense for Kodak to invest in digital photography? Why or why not?

How would you evaluate their ability to execute their strategy? Why did the firm encounter difficulties?

What might they have done differently?

What should Kodak do next?

Class 23: Selected Student Presentations

Class 24: Conclusions and Reflections

No required reading!

Bring your questions and/or reflections on the content so far to class. This is the last required class.