

## COURSE OBJECTIVES AND TOPICS

Industrial Innovation Science is a survey and analysis course that aims to develop an understanding of the basic elements of innovation, processes and models for innovating, managing innovation, and how organizations innovate. The emphasis is not on any specific innovation, but rather on the *process elements and requisites* for innovation from classical readings published on this topic. Course topics include:

- Tools and Processes for Innovating
- Organizational Factors including leadership, culture, and people and teams in Innovation
- Collaboration, Networks and Innovation
- Technology/Data and Innovation
- Measurement of Innovation including innovation portfolio management, revenues, and costs
- Lessons from innovation in industry

The format of the class is discussion of readings on innovation, discussion of case studies on various aspects of innovation, and a review of innovations. At the end of the course, the student is expected to:

- a. develop understanding of factors, good and bad, that impact innovation;
- b. develop an appreciation for how real businesses and organizations innovate;
- c. be able to develop a structure/framework for innovating, and
- d. identify factors to include in studies of innovation; and
- e. critically evaluate and analyze innovation efforts and present data about innovation efforts.

## CLASS MEETINGS

Tuesdays 6 PM to 8:50 PM, in Physical Sciences Building 222A.

## COURSE WEBPAGE

The course has a Blackboard page where course materials will be posted. Course assignments will be submitted electronically via Blackboard (this will be set up end of week 1). All written feedback will be provided via Blackboard as well.

## INSTRUCTOR AND OFFICE HOURS

Dr. Arunkumar Pennathur, [apennathur@utep.edu](mailto:apennathur@utep.edu); Email is the fastest way to reach me. I check my email at least twice daily and will respond within a day if I am not traveling, and within 2 to 3 days if I am on the road. I usually do not check emails Saturdays and Sundays, so all emails sent to me after Friday 5 PM will be queued for responses beginning Monday.

**Office Location:** Engineering Building A240.

**Office Hours:** Tuesdays 330 PM to 530 PM. I will also have office hours via Teams at this time in addition to physically being present in my office during this time (this will be set up end of week 1).

## COURSE TEXT AND OTHER MATERIALS

There is no formal textbook for this course. The course will use several readings [articles on innovation], a set of book chapters and a set of case studies. Readings from journals are available in the UTEP library. The reading list is provided in the syllabus. Due to copyright restrictions, articles cannot be posted on Blackboard, but they are available in the library for your access via your UTEP login.

The case list is provided in the syllabus. The book chapters and case studies are available in electronic format for this course as a packet. The cost is for copyright clearance for the cases and the book chapters. The packet will be activated based on enrolment in course [after class 1], and the class will be emailed the link to download the case materials and the book chapters.

## COURSE GRADING

The course will include the following grading components:

Case Analysis and Discussion	20% (spread over ~2 cases per team)
In class reading discussions	20%
Written Reflections [any 5 readings]	40% [choose 5 readings, or your own readings on any aspect of innovation; 8% each reflection]
Innovation Identification and Presentation	20%

Letter grades for the course will be assigned based on the following scale:

- A: 90 and above
- B: 80-89
- C: 70-79
- D: 60-69
- F: Below 60

**Case analyses:** There will be 10 case assignments on various aspects of industrial innovation in the class. Teams will analyze, present, and facilitate discussion for a case [teams will be formed on the first day of class]. Guiding questions for the case discussions will be posted online on Blackboard. You can add additional questions that emerge during your reading and analysis of the case during the discussion. The case list is as follows:

1. Best Buy: Merging lean six sigma with innovation, BAB Case No. 697.
2. Herman Miller (A): Innovation by design, HBS Case No. 9-602-023.
3. Innovation at Timberland: Thinking outside of the shoe box, HBS Case No. 9-306-064.
4. Open innovation at Siemens, HBS Case No. 9-613-100.
5. Innovation at 3M Corporation (A), HBS Case No. 9-699-012.
6. Business teams at Rubbermaid, HBS Case No. 9-897-165.
7. Eli Lilly & Co: Innovation in diabetes care, HBS Case No. 9-696-077.
8. CVS Health: Prescription for Transformation, HBS Case Product #322091-PDF-ENG.
9. The strategic transformation of Royal Phillips, London Business School, Case Product #LBS338-PDF-ENG.
10. Responsible AI: Tackling tech's largest corporate governance challenges, Haas Berkeley Case Product #B6021-PDF-ENG.

Case analyses should include the following: (1) a brief presentation [you can use any medium that facilitates discussion, including PPT, MS Word, Text Files etc.] outlining the case and any background

information for setting the stage for discussion; (2) key questions and topics addressed in the case; (3) a brief analysis of case information [can be qualitative or quantitative or a combination of the two]; (4) key insights and takeaways from the case. Please upload your case presentation and notes on Blackboard for the respective case assignment before the discussion.

Your contribution to the case discussion will be evaluated based on the following criteria: 1. Preparation [5 points]; 2. Facilitation of case discussion [5 points]; 3. Clarification/bringing out central ideas in case [5 points], and 4. Key takeaways relating to innovation and/or new insights, new questions raised [5 points].

The case and readings course pack is available at: <https://hbsp.harvard.edu/import/1018239>.

***Reading class discussion activity and written reflections:*** The majority of class time will be spent in discussing classic articles from leading thinkers on innovation. Class discussions will help bring out varied perspectives on the elements of innovation, as well as provide a forum for critically and thoughtfully thinking about innovation. Class discussions will be team-based activities.

There will be 2 components to the article reading and discussions:

1. Leading and participating in discussions for the articles posted.
2. Every student will complete individual written reflections for any 5 readings of their choice from all the readings in the class. You can also pick other articles on innovation to write about.

I will post discussion questions for every article on Blackboard at least a week prior to the assigned date for discussion.

The discussions will typically summarize the article, and discuss key questions. Teams are expected to be ready with well thought-out responses for the discussion questions, any additional sources about the topic and facilitate peers to discuss the questions. Written responses to the questions are not required. You are encouraged to consult other external sources/readings as relevant to help steer the discussions. Your contribution to the discussion will be evaluated based on the following criteria: 1. Preparation [5 points]; 2. Facilitation of discussion [5 points]; 3. Clarification/bringing out central ideas in article [5 points], and 4. Identification and summarizing of key takeaways relating to innovation and/or new insights, new questions raised [5 points].

In addition to participating in class discussions, each student should complete a written individual reading summary for up to 5 readings total in the semester. The reading reflection should contain your understanding of the key issues in the reading, and should reflect your considered analysis and thoughts, rather than be just a straight summary of what is contained in the paper.

***Identification and presentation of innovations:*** You will identify and present one innovation in any domain that interests you. The innovation could be a unique process innovation, a product innovation in any application setting including service industry settings. Some domains may be specific branches of engineering [manufacturing, materials, energy, etc.], health and medicine, science, etc. In a class presentation, the following aspects need to be addressed: (1) what is the innovation; (2) why is it an innovation; (3) the story behind the innovation; and (4) any timelines and other interesting information about the innovation including impact of the innovation.

## READING LIST

(Readings marked in yellow are available in the course packet:

<https://hbsp.harvard.edu/import/1018239>).

### *Innovation Tools and Processes*

1. Luma Institute, A taxonomy of innovation, Luma Institute, HBR, Volume 92, Issue 1/2, Jan-Feb 2014, p30-31.
2. B. Shneiderman. Creativity support tools: Accelerating discovery and innovation, Communications of the ACM, Vol 50, No. 12, p20-32, December 2007.
3. L.A. Bettencourt and A. W. Ulwick. The customer-centered innovation map. HBR, May 2008, p2-8.
4. J. M. Utterback. Differences in innovation for assembled and non-assembled products, Chapter 6, Excerpted from Mastering the dynamics of innovation [available in the course packet].
5. J. R. Immelt, V. Govindarajan and C. Trimble. How GE is disrupting itself. HBR, October 2009, p3-11.
6. O. M. Bjelland and R. C. Wood. An inside view of IBM's innovation jam. MIT Sloan Mgmt Review, Vol 50, No. 1, Fall 2008, p32-40.
7. J. F. Suri. Informing for intuition: Design research for radical innovation. Rotman Magazine, Winter 2008, p53-57, [available in course packet].
8. C. B. Dobni. The innovation blueprint. Business Horizons, Vol 49, p329-339, 2006.
9. R. W. Rycroft. Does cooperation absorb complexity? Innovation networks and the speed and spread of complex technological innovation. Technological Forecasting and Social Change. 74, 565-578, 2007.
10. C. K. Prahalad and R. A. Mashelkar. Innovation's holy grail. HBR, July-August 2010, p2-10.
11. A. King and K. R. Lakhani. Using open innovation to identify the best ideas. MIT Sloan Mgmt Review. Vol 55, No. 1, p41-48, Fall 2013.
12. R. W. Rycroft and D. E. Kash. Self-organizing innovation networks: implications for globalization. Technovation, 24, 187-197, 2004.
13. R. M. Kanter. Innovation: The classic traps. HBR, November 2006. p 1-12.
14. P. F. Drucker. The discipline of innovation. HBR, 2002, p5-10.

### *Organizational Factors and Innovation*

1. T. Amabile, C.M. Fisher and J. Pillemer. IDEO's culture of helping, HBR, Volume 92, Issue 1/2, Jan-Feb 2014, p54-61.
2. R. L. Martin. The innovation catalysts. HBR, June 2011, p2-7.

3. J. Dyer, H. Gregersen and C. M. Christensen, Putting the innovators DNA into practice: People. Chapter 8, Excerpted from The Innovators DNA: Mastering the five skills of disruptive innovators, 2011. [available in the course packet].

4. J. Birkinshaw, J. Bessant and R. Delbridge. Finding, forming and performing: Creating networks for discontinuous innovation. California Management Review, Vol 49, No. 3, Spring 2007, p67-84.

5. T. Kelley. The ten faces of innovation. Rotman Magazine, Spring/Summer 2006, p30-33.

### ***Technology, data and innovation***

1. R. Parmar, I. Mackenzie, D. Cohn, and D. Gahn. The new patterns of innovation, HBR, Volume 92, Issue 1/2, Jan-Feb 2014, p86-95.

2. M. S. Shepard et. al. Bringing HPC to engineering innovation. Computing in Science and Engineering, Jan/Feb 2013, p16-25.

3. B. Iyer and T. H. Davenport. Reverse engineering Google's innovation machine, HBR, Volume 86, Issue 4, April 2008, p58-68.

4. E. Prandelli, G. Verona and D. Raccagni. Diffusion of web-based product innovation. California Management Review. Vol 48, No. 4, Summer 2006, p 109-135.

### ***Measurement of Innovation***

1. S. D. Anthony et al. Innovation metrics. Chapter 10, Excerpted from Innovators guide to growth: Putting disruptive innovation to work. [available in the course packet].

2. B. Nagji and G. Tuff. Managing your innovation portfolio. HBR, May 2012, p2-9.

3. P. Skarzynski and R. Gibson. Managing and multiplying resources: Maximizing the return on innovation. Chapter 8, Excerpted from Innovation to the core: A blueprint for transforming the way your company innovates, 2008. [available in the course packet].

4. S. H. Thomke. Capturing the real value of innovation tools. MIT Sloan Mgmt Review, Vol 47, No. 2, Winter 2006, p24-32.

5. G. S. Day. Is it real? Can we win? Is it worth it? HBR, December 2007, p1-13.

6. C. M. Christensen, S. P. Kaufman, and W. C. Shih, Innovation killers. HBR, January 2008, p1-8.

### **Schedule (Tentative and will be finalized by end of week 1)**

#### **January 17**

Course and syllabus introduction

Library and finding the articles for discussion

Form teams

Finalize discussion assignments/case picks

Identify and download reading discussion articles from UTEP library

Initial ideas on what constitutes innovation and what does not

### **January 24**

1. Luma Institute, A taxonomy of innovation, Luma Institute, HBR, Volume 92, Issue 1/2, Jan-Feb 2014, p30-31.
2. B. Shneiderman. Creativity support tools: Accelerating discovery and innovation, Communications of the ACM, Vol 50, No. 12, p20-32, December 2007.
3. L.A. Bettencourt and A. W. Ulwick. The customer-centered innovation map. HBR, May 2008, p2-8.

### **January 31**

4. J. M. Utterback. Differences in innovation for assembled and non-assembled products, Chapter 6, Excerpts from Mastering the Dynamics of Innovation.
5. J. R. Immelt, V. Govindarajan and C. Trimble. How GE is disrupting itself. HBR, October 2009, p3-11.
6. O. M. Bjelland and R. C. Wood. An inside view of IBM's innovation jam. MIT Sloan Mgmt Review, Vol 50, No. 1, Fall 2008, p32-40.

### **February 7**

7. J. F. Suri. Informing for intuition: Design research for radical innovation. Rotman Magazine, Winter 2008, p53-57.
8. C. B. Dobni. The innovation blueprint. Business Horizons, Vol 49, p329-339, 2006.
9. R. W. Rycroft. Does cooperation absorb complexity? Innovation networks and the speed and spread of complex technological innovation. Technological Forecasting and Social Change. 74, 565-578, 2007.

### **February 14**

#### **Case 1: Best Buy: Merging lean six sigma with innovation, BAB Case No. 697.**

10. C. K. Prahalad and R. A. Mashelkar. Innovation's holy grail. HBR, July-August 2010, p2-10.
11. A. King and K. R. Lakhani. Using open innovation to identify the best ideas. MIT Sloan Mgmt Review. Vol 55, No. 1, p41-48, Fall 2013.
12. R. W. Rycroft and D. E. Kash. Self-organizing innovation networks: implications for globalization. Technovation, 24, 187-197, 2004.

### **February 21**

#### **Case 2: Herman Miller (A): Innovation by design, HBS Case No. 9-602-023.**

13. R. M. Kanter. Innovation: The classic traps. HBR, November 2006. p 1-12.
14. P. F. Drucker. The discipline of innovation. HBR, 2002, p5-10.

15. T. Amabile, C.M. Fisher and J. Pillemer. IDEO's culture of helping, HBR, Volume 92, Issue 1/2, Jan-Feb 2014, p54-61.

### **February 28**

#### **Case 3: Innovation at Timberland: Thinking outside of the shoe box, HBS Case No. 9-306-064.**

16. R. L. Martin. The innovation catalysts. HBR, June 2011, p2-7.

17. J. Dyer, H. Gregersen and C. M. Christensen, Putting the innovators DNA into practice: People. Chapter 8, Excerpted from The Innovators DNA: Mastering the five skills of disruptive innovators, 2011. [available in the course packet].

18. J. Birkinshaw, J. Bessant and R. Delbridge. Finding, forming and performing: Creating networks for discontinuous innovation. California Management Review, Vol 49, No. 3, Spring 2007, p67-84.

### **March 7**

#### **Case 4: Open innovation at Siemens, HBS Case No. 9-613-100.**

19. T. Kelley. The ten faces of innovation. Rotman Magazine, Spring/Summer 2006, p30-33.

20. R. Parmar, I. Mackenzie, D. Cohn, and D. Gahn. The new patterns of innovation, HBR, Volume 92, Issue 1/2, Jan-Feb 2014, p86-95.

21. M. S. Shepard et. al. Bringing HPC to engineering innovation. Computing in Science and Engineering, Jan/Feb 2013, p16-25.

### **March 14: NO CLASS SPRING BREAK**

### **March 21**

#### **Case 5: Innovation at 3M Corporation (A), HBS Case No. 9-699-012.**

22. B. Iyer and T. H. Davenport. Reverse engineering Google's innovation machine, HBR, Volume 86, Issue 4, April 2008, p58-68.

23. E. Prandelli, G. Verona and D. Raccagni. Diffusion of web-based product innovation. California Management Review. Vol 48, No. 4, Summer 2006, p 109-135.

24. S. D. Anthony et al. Innovation metrics. Chapter 10, Excerpted from Innovators guide to growth: Putting disruptive innovation to work. [available in the course packet].

### **March 28**

#### **Case 6: Business Teams at Rubbermaid.**

25. B. Nagji and G. Tuff. Managing your innovation portfolio. HBR, May 2012, p2-9.

26. P. Skarzynski and R. Gibson. Managing and multiplying resources: Maximizing the return on innovation. Chapter 8, Excerpted from Innovation to the core: A blueprint for transforming the way your company innovates, 2008. [available in the course packet].

27. S. H. Thomke. Capturing the real value of innovation tools. MIT Sloan Mgmt Review, Vol 47, No. 2, Winter 2006, p24-32.

#### **April 4**

##### **Case 7: Innovation in Diabetes Care: Eli Lilly and Company.**

28. G. S. Day. Is it real? Can we win? Is it worth it? HBR, December 2007, p1-13.

29. C. M. Christensen, S. P. Kaufman, and W. C. Shih, Innovation killers. HBR, January 2008, p1-8.

#### **April 11**

##### **Case 8: CVS Health: Prescription for transformation.**

Getting ready for innovation identification final presentations

#### **April 18**

##### **Case 9: The strategic transformation of Royal Phillips.**

Innovation identification presentations – 5 presentations each for about 15 minutes

#### **April 25**

##### **Case 10: Responsible AI: Tackling tech's largest corporate governance challenges.**

Innovation identification final presentations – 5 presentations each for about 15 minutes

#### **May 2**

Innovation Identification Final Presentations – 5 presentations each for about 15 minutes