

Stanford University Civil and Environmental Engineering

CEE 175S/ 275S

Environmental Entrepreneurship and Innovation

Schedule: Thursdays, time and room to be announced

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Course Description

Innovation and entrepreneurship are crucial to enhancing and advancing the capacity of our current infrastructure to provide critical services – clean water, energy, transportation, and environmental protection. Emerging technologies can help achieve these objectives, but choosing among numerous possible alternatives can be daunting. CEE 175S/275S introduces entrepreneurship for students interested in working with or launching new products or services that offer sustainable environmental and/or social benefit. This course is about developing the analytical and conceptual skills required to assess the potential for new environmental ventures. The opportunity analysis process involves identifying, evaluating and determining whether or not to pursue an opportunity.

This course seeks to enlighten future entrepreneurs, engineers, and policy makers to critically evaluate, analyze, and choose among alternatives that are most likely to produce the desired results. Realization of outcomes depends on understanding the stakeholders involved in the overall value chain, the economics and opportunity costs of each path, making decisions despite incomplete information, and ultimately recognizing the risks and viability of our choices. Many constraints and opportunities are unique to this sector, a sector where utilities are important players, where the risks and rewards can differ substantially from those in the private sector.

Course Objectives

The course will introduce a variety of analytical approaches and perspectives useful for entrepreneurial, engineering, and policy making careers. These include systems thinking, opportunity recognition, tradeoffs, net impact, value chain analysis, stakeholder identification, opportunity costs, trending driving forces, and surfing the learning curve. Students will learn how to focus on value added scenarios and build value propositions for new venture concepts and environmental opportunities.

Course Organization

Class time will include lectures, project due diligence, group discussions, and student presentations. The early classes will focus on learning new skills and analytical tools. Midway classes will emphasize assessment of proposals from the perspective of various roles such as entrepreneur, investor, industry, or agency representative. Homework will involve reading a number of papers, creating proposal abstracts, assessing projects, and generating and critiquing value propositions.

Course Materials

A list of papers will be provided online. Papers are to be read outside of class and are typically between 3 to 20 pages in length. Two to four papers relevant to each class will be required reading prior to class in preparation for discussion during class.

Prerequisites

An understanding of basic economics is recommended. Some technical background in engineering or science, as education or as experience would be helpful, but not necessary.

Course Requirements

Each student is expected to read the assigned articles prior to class and to participate in both class discussions and group activities (consisting of project assessments or evaluations). Each student (or small group) will deliver at least one presentation (of 5 to 10 minutes) in front of the class.

Each student should plan to provide one or two projects to propose during the class. The project proposals can be old or new ideas to enhance environmental services or to create a business. Proposals do not need to be owned or validated, but the ideas will be exposed to due diligence and assessment by the students to gain experience in these skills.

Attendance and Participation

Students are expected to attend every class meeting. Students remain responsible for submitting work due even if absent. Students should e-mail the instructor prior to any missed class.

Students remain responsible for the material covered and assignments given during an absence and are to discern this information from their peers. Attendance at all class sessions is critical to the learning process and the

participation component of the course. Entrepreneurship is a collaborative and interactive process. Entrepreneurs find opportunities, adapt, and improve themselves by listening and learning from others. Please come to class prepared to participate in the day's activities.

Evaluation and Grading

Grades will be based on attendance and completion of homework assignments. In addition, individual participation during class and participation in group projects will be assessed in final grades.

Environmental Entrepreneurial Project

Working individually and with teams, students will exercise their skills and abilities to analyze opportunities from business and environmental perspectives and ultimately create credible value propositions.

Opportunity Analysis

Opportunity Characterization & Value Proposition

What characteristics define the opportunity? What are the key cost and performance metrics? What problems or customer pain does it solve? What solutions, benefits or outcomes could it offer? What obstacles might current and future stakeholders pursue?

Market Segment and Stakeholders

What would be a promising first market segment? Who might be early adopters? Is this creating a new market or re-segmenting an existing market? Who are the stakeholders, i.e. buyers, decision makers, users, influencers? How will capital markets and existing infrastructure respond?

Value Chain & Competitors

Where does a new product or service fit in the value chain? Who are potential partners, channels and suppliers? How much disruption will be caused? Who are existing and emerging competitors? What are alternative products & services? Will customers present inertia as barriers to entry/exit? How could real or perceived switching costs be addressed?

"Minimum Viable Product"

What product or service configuration could be offered with the fewest features that customers need to "pay" for? What can be offered initially to test a value proposition within the resources available?

Cost Modeling

What are the startup costs? What market research can help estimate these costs? Is the business model high-margin/low-volume, low-margin/high-volume, or other? Could partners help provide resources and/or perform key activities?

What are the customer acquisition costs?

Revenue Projections, Sources of Capital

For what value are customers really willing to pay? Who are they, what do they currently pay? How long will it really take to deliver a first product to a first paying customer? Can you leverage non-dilutive funding in the meantime (grants, non-recurring engineering)?

SWOT and Next Steps

What are your strengths, weaknesses, opportunities, threats, and key mitigation strategies? o What are the specific and actionable next steps to improve market viability?

Optional Reading

Four Steps to the Epiphany, Steve Blank.

Use the link below to access a special student discount through Amazon. The cost of this textbook is \$19.95 with the discount. Note: Must be ordered from a .edu email address and/or shipped to an educational institution.

<http://www.stevenblank.com/books.html>

Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Alexander Osterwalder and Yves Pigneur

Accessibility

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk; phone: 723-1066; web site: <http://studentaffairs.stanford.edu/oea>.

Honor Code

The Honor Code applies to both instructors and students. The text is reproduced below; for more information, see <http://studentaffairs.stanford.edu/communitystandards/policy/honor-code>. Violations of the Honor Code will be taken extremely seriously in this class.

The Honor Code is an undertaking of the students, individually and collectively:

- that they will not give or receive aid in examinations; that they will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading;
- that they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor Code.

The faculty on its part manifests its confidence in the honor of its students by refraining from proctoring examinations and from taking unusual and unreasonable precautions to prevent the forms of dishonesty mentioned above. The faculty will also avoid, as far as practicable, academic procedures that create temptations to violate the Honor Code.

While the faculty alone has the right and obligation to set academic requirements, the students and faculty will work together to establish optimal conditions for honorable academic work.