



Entrepreneurship in Engineering Education

“Closing the Gap”

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Entrepreneurship...



Today much confusion exists about the proper definition of entrepreneurship...

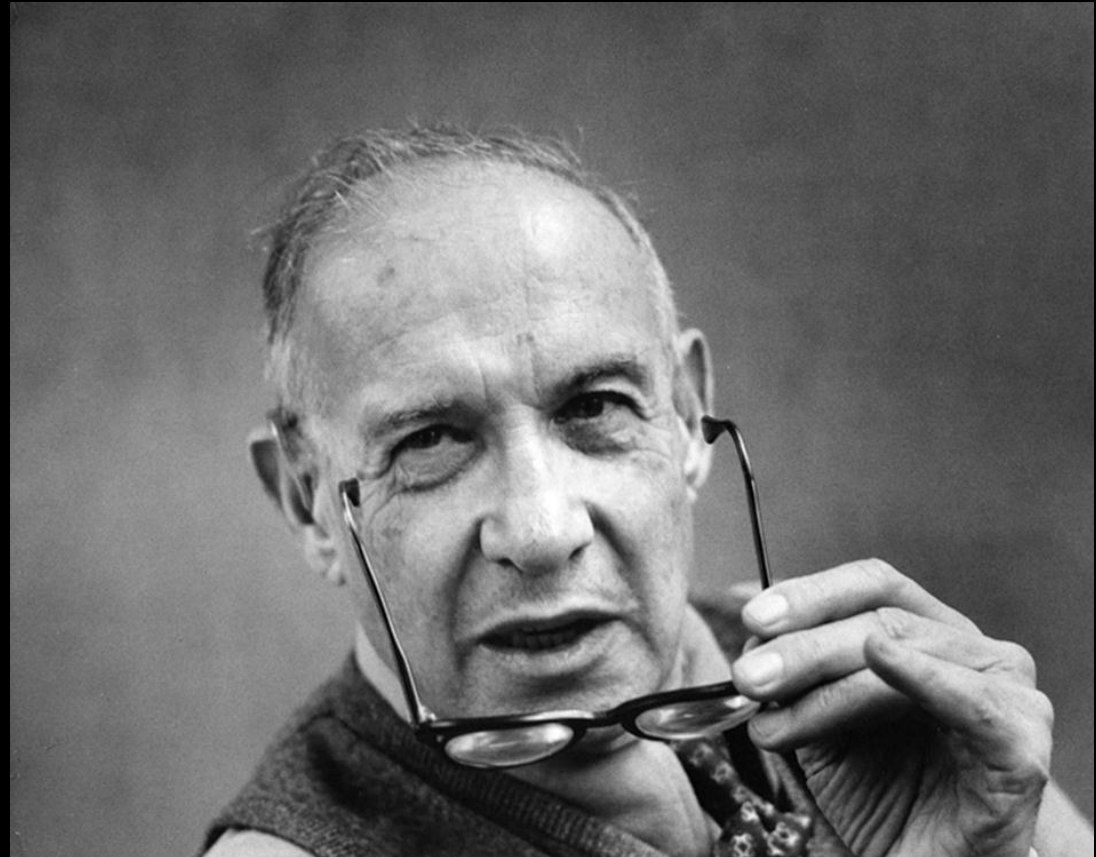
Peter Drucker

The Discipline of Innovation

HBR, 1998

75,000

25,000



Today much confusion exists about the proper definition of entrepreneurship...

Peter Drucker

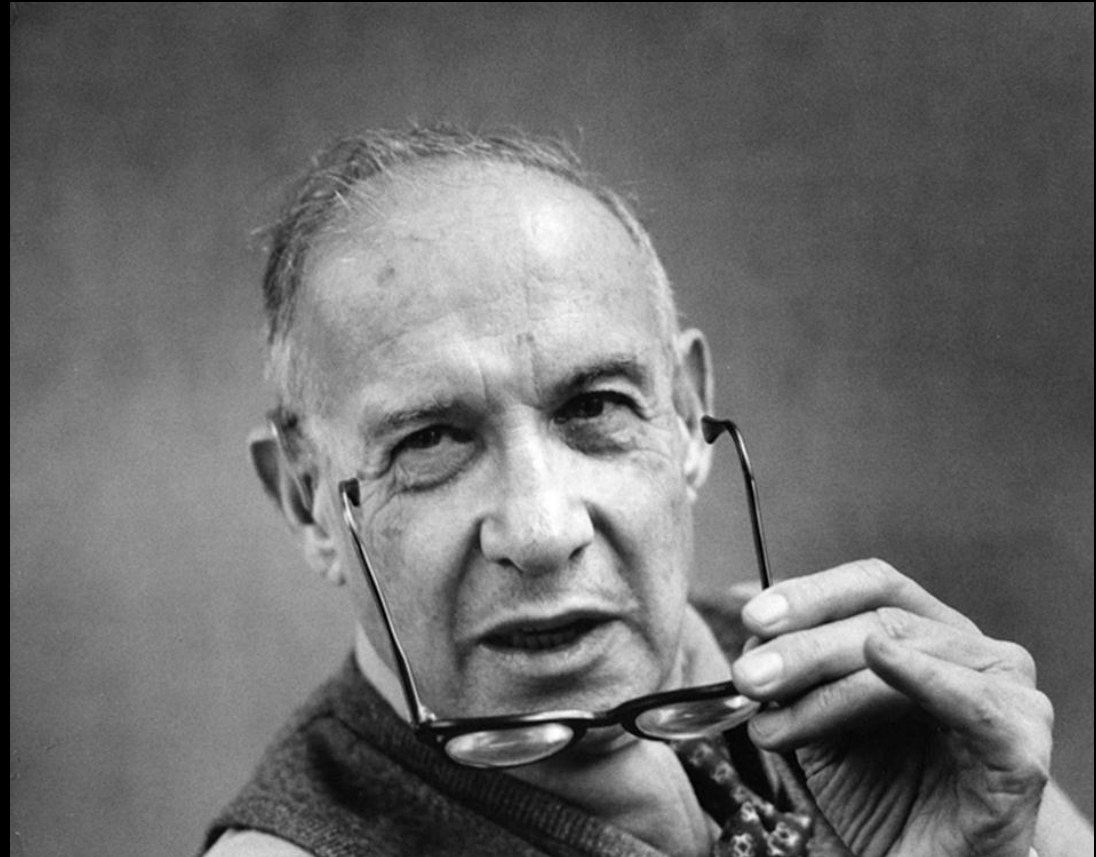
The Discipline of Innovation

HBR, 1998

Books on www.amazon.com

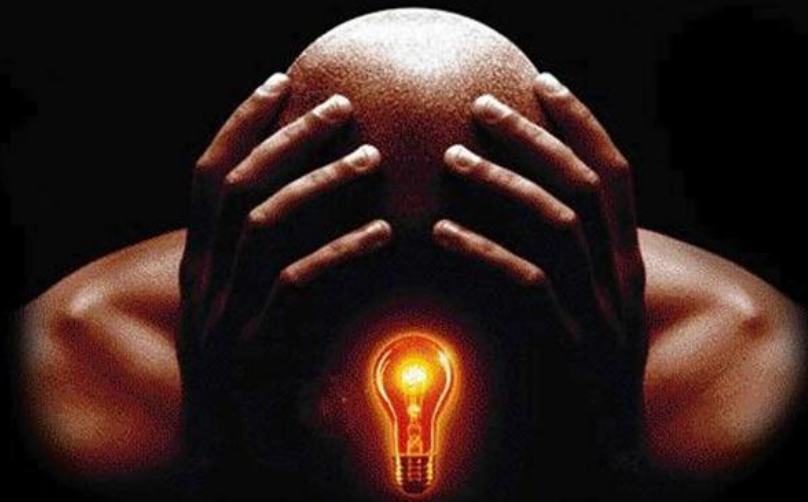
75,000 - Leadership

25,000 - Entrepreneurship



*What all the successful entrepreneurs I have met have in common is **not** a certain kind of personality but a commitment to the systematic practice of innovation.*

Peter Drucker, HBR, 1998



MIND OF AN
ENTREPRENEUR

- I. Foundations of Entrepreneurship
- II. Technology Entrepreneurship Today
- III. Innovation
- IV. A Curriculum Example

Foundations of Entrepreneurship

History – 18th Century

The *words* *entreprendre*, *entreprise*, and *entrepreneur* used in the sense of *designing and undertaking some project*

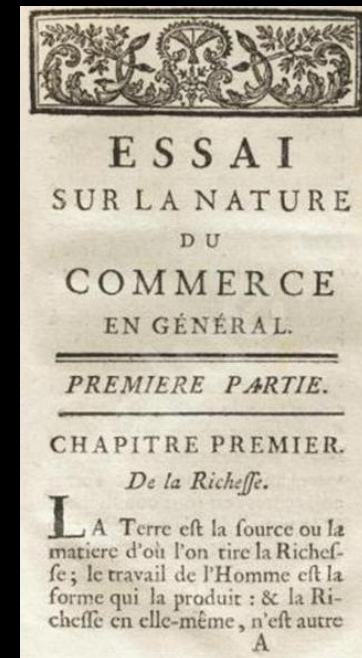
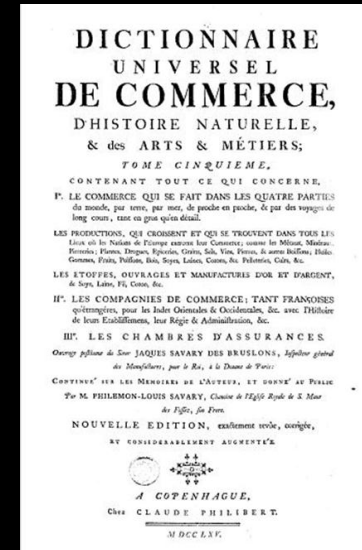
Jacques Savary des Brûlons (1723, *Dictionnaire du Commerce*)

[Problems and Challenges in Teaching Business History in Professional Education for Business, John G. B. Hutchins, *Bulletin of the Business Historical Society*, Vol. 24, No. 3 (Sep., 1950), pp. 146-156; *Dictionary of political economy*, Volume 3, Sir Robert Harry Inglis Palgrave, Macmillan and co., 1901]

Entrepreneurship used in the modern enterprise context with the distinguishing feature being reliance on “*unfixed wages*”

Richard Cantillon (1755, *Essai sur la nature du commerce en general*)

[On the origins of classical economics: distribution and value from William Petty to Adam Smith, Psychology Press, 1996, p. 82]



History – 19th Century

Entrepreneurs as “Captains of Industry”

Francis Amasa Walker

[The Wages Question: A Treatise on Wages and the **Wages Class**, New York: A.M. Kelley, 1968]



THE
WAGES QUESTION

A TREATISE ON

WAGES AND THE WAGES CLASS

BY

FRANCIS A. WALKER, M.A., Ph.D.

*Professor of Political Economy and History, Harvard
University; Member of the U. S. Bureau of Statistics; Superintendent
of the Stock Census; Author of the Statistical
Atlas of the United States.*

London

MACMILLAN AND CO.

1876



20th Century - Schumpeter

"...the entrepreneur and his function are not difficult to conceptualize: the defining characteristic is simply the doing of new things or the doing of things that are already being done in a new way (innovation)."

[Joseph A. Schumpeter, "The Creative Response in Economic History," J.E.H., Nov., 1947, pp. 149-59]

CREATIVITY
DESTROYER

20th Century - Redlich



“Those who provide the capital can be called capitalists, those who determine the purpose, the spirit, and the place of the enterprise in the market and the national economy can be called entrepreneurs, and those who keep the organization functioning can be styled managers.... It is not correct to define the entrepreneur, as has been done, as the man who makes the decisions within the enterprise. In fact, all three make decisions.”

Present - 21st Century

Successful business startups are founded by talented individuals using ideas they had during their prior employment. As Schumpeter [and Drucker] wrote, entrepreneurial ventures seem to be more about ideas and talent and less about individual characteristics and preferences.

From Schumpeterian E-ship: (Bhidé [2000], Kaplan et al. [2005], Klepper and Thompson [2009]).



Technology Entrepreneurship Today

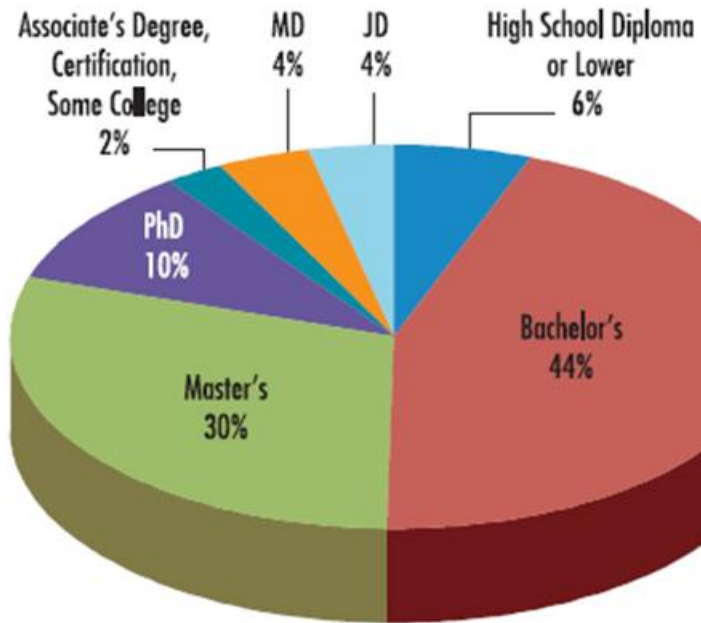
Education and Tech Entrepreneurship

KAUFFMAN
The Foundation of Entrepreneurship

Vivek Wadhwa, Richard Freeman, Ben Rissing, 2008

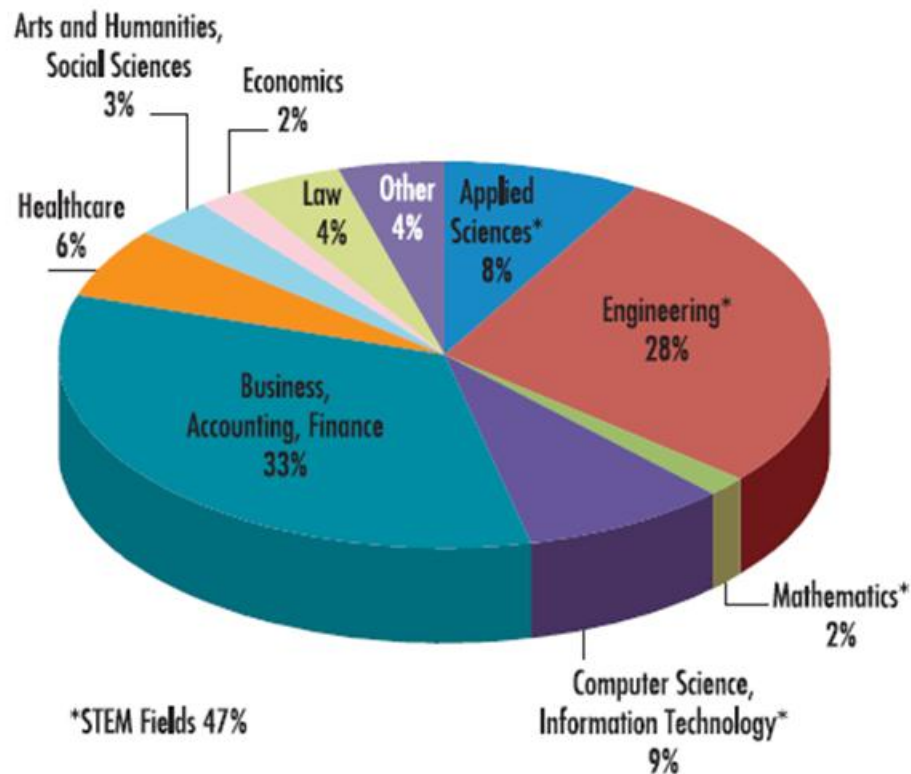
Terminal Degree

Figure 1:
Terminal Degree Completed
by U.S.-Born Tech Founders



Field of Terminal University Degree

Figure 2:
Fields of Terminal Degrees Completed
by U.S.-Born Tech Founders



Age

Figure 3:
U.S.-Born Tech Founders' Age at Time of Company Founding

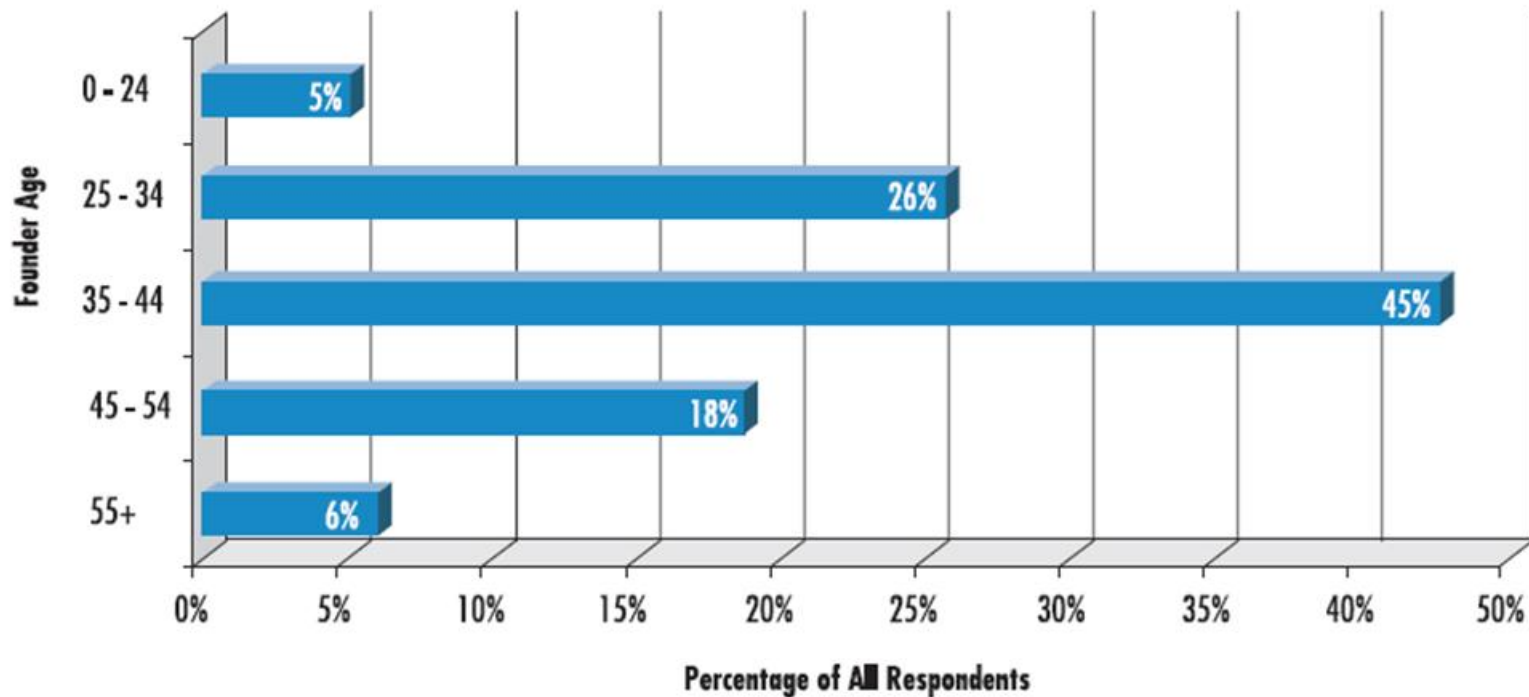


Figure 4:
Time Lag Between Completion of Terminal
Education and Company Founding

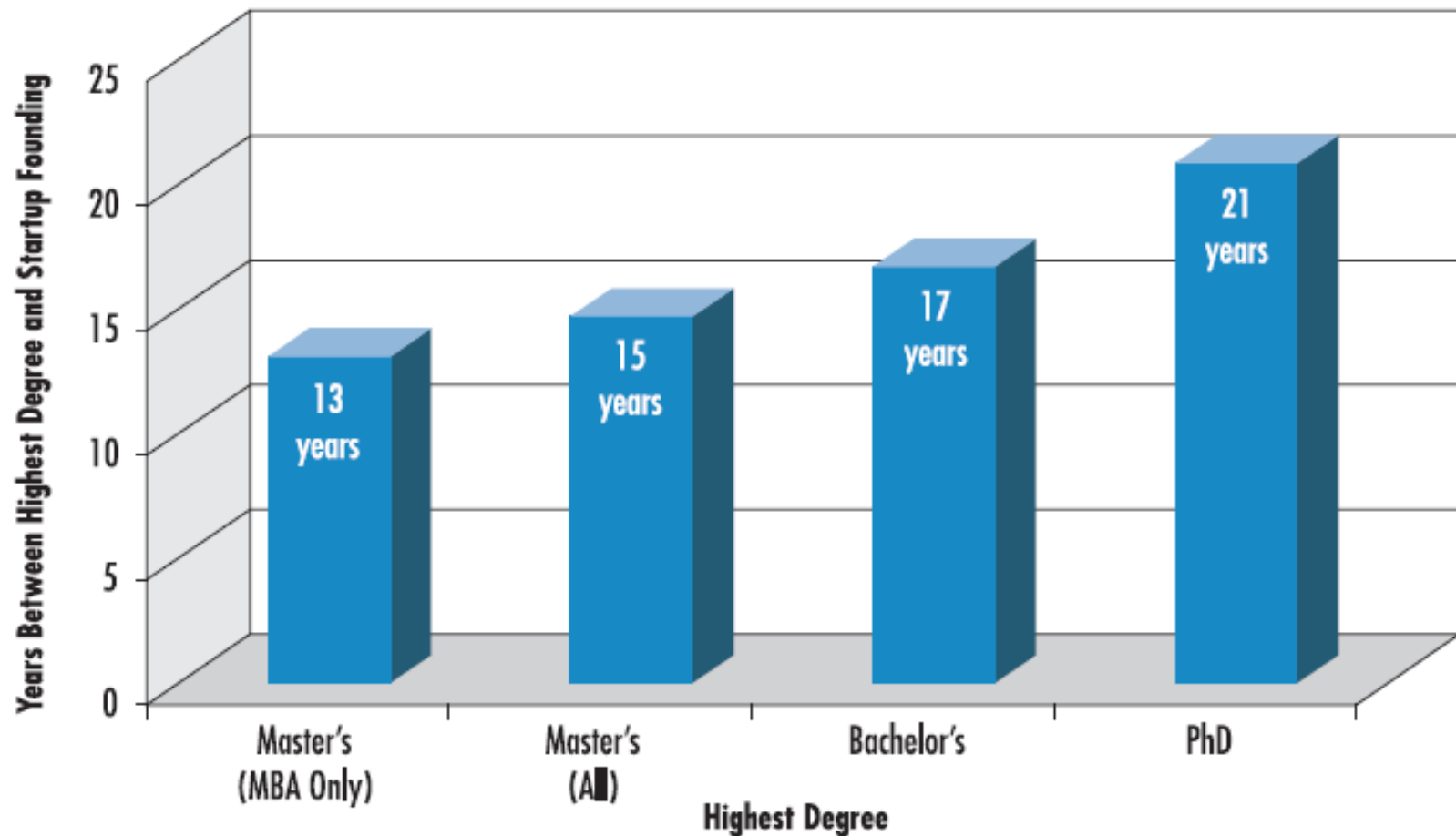
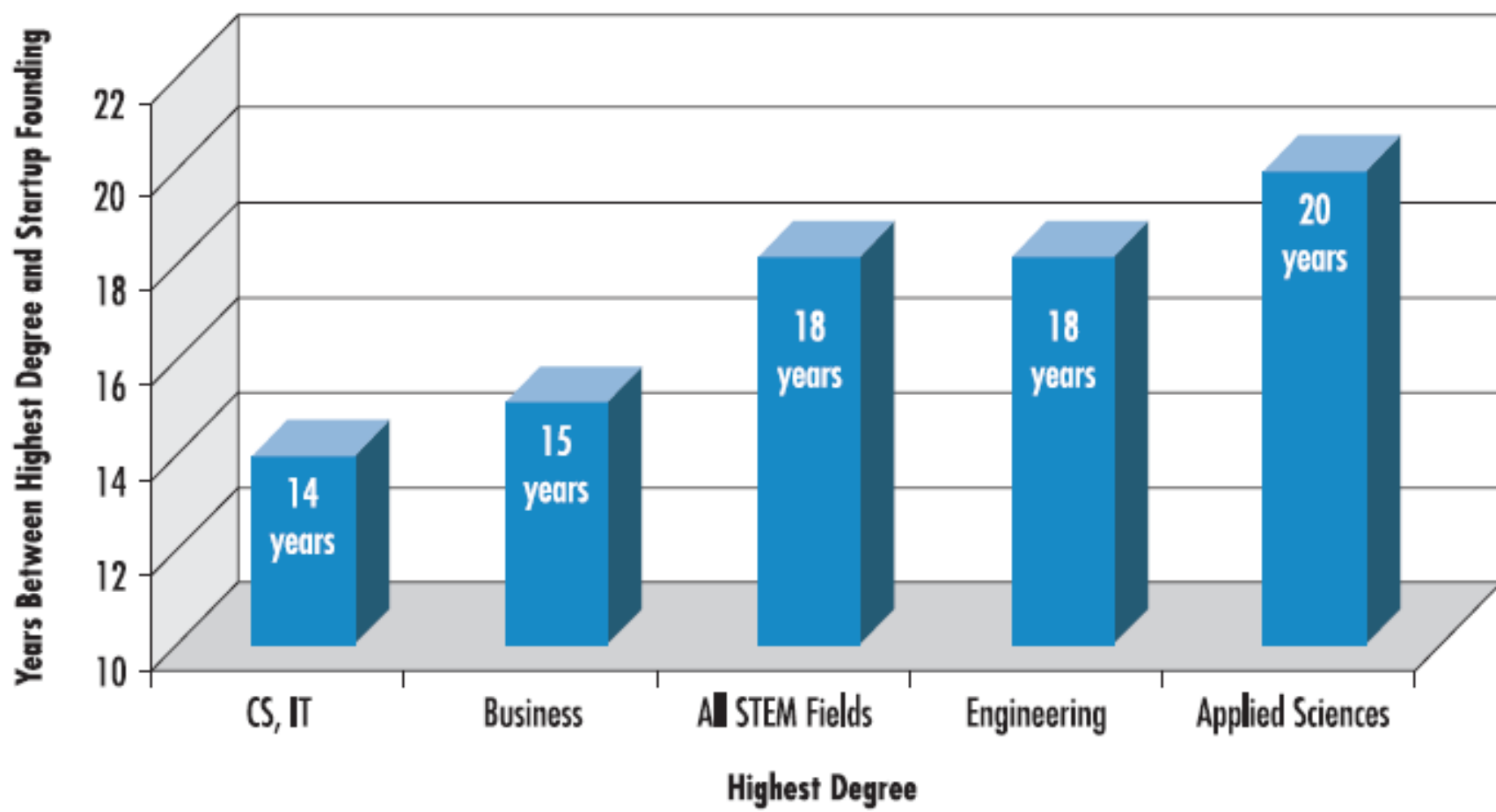


Figure 5:
Time Lag Between Completion of Terminal Degree and Company Founding by Field of Study





Terminal degree either BS → MS/MBA

Degree(s) in Business → Engineering

Between 35 → 44 years old

Lag time of 13 → 17 years between degree and startup
(18 years for engineering)

Opinion

Entrepreneurs look at the world through eyes different than most – they see creative opportunities in the world where others see irritations. They capture value through this creative thought. For many it may take entering the workforce to see these opportunities.

While it may take time to see opportunities, there is no time constraint on developing the necessary vision skills nor on practicing creative thought and innovative synthesis.

Innovation

**Conventional wisdom is the
greatest barrier to
innovation.**

Robert Pittman,

Founder, MTV.com

Innovation

Capturing value from creativity

The Creative Power of Spaces



MIT – Building 20

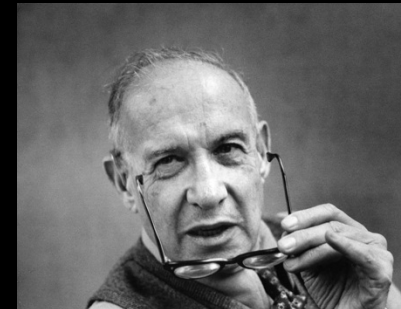
The Creative Power of Spaces



Steve Jobs – Pixar Headquarters

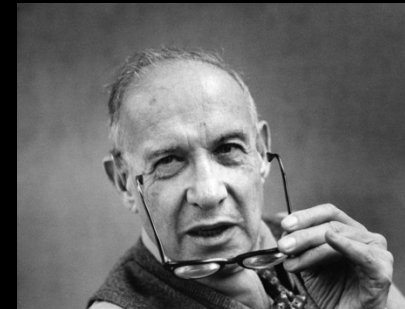
*If an innovation does not aim at **leadership** from the beginning, then it is unlikely to be innovative enough.*

BHAG

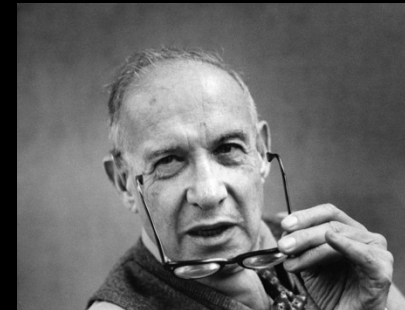
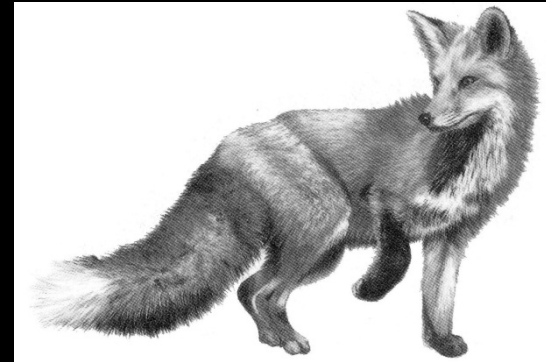
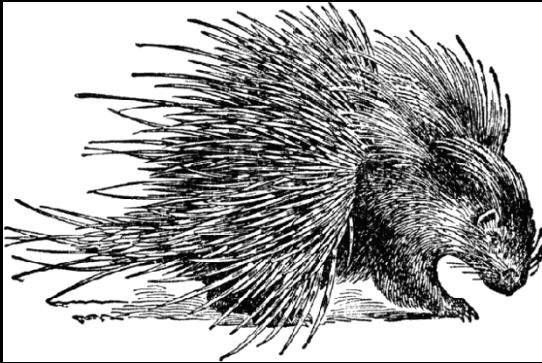


*Because innovation is both conceptual
perceptual, would-be innovators must also go
out and **look, ask and listen.***

Empathic Processes

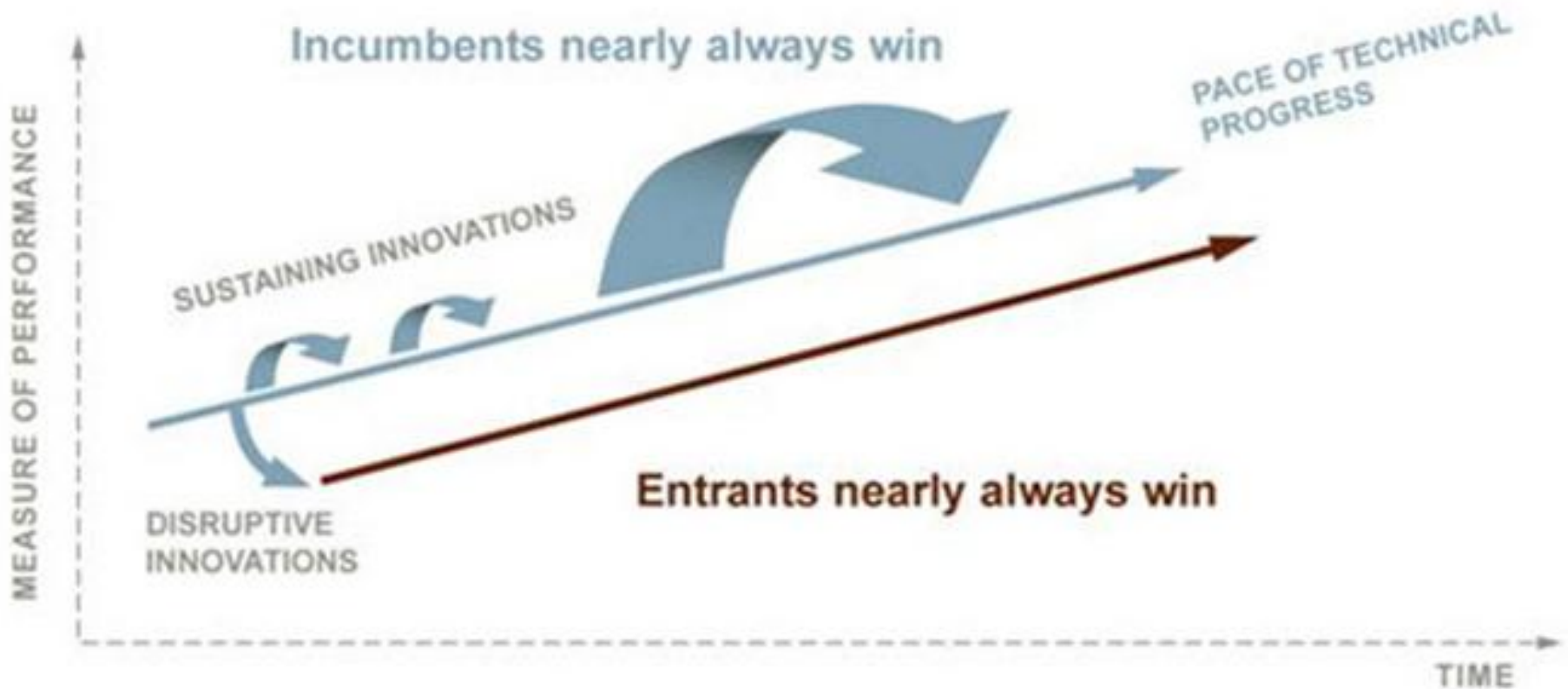


To be effective, an innovation has to be simple, and it has to be focused.



www.claytonchristensen.com

Disruptive Innovation

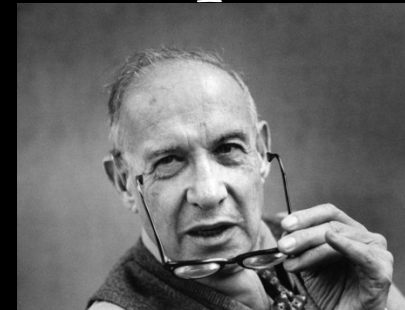




*Genius is 1% inspiration and
99% perspiration.*

Thomas Edison

*Above all, innovation is **work** rather than
genius. It requires knowledge. It often requires
ingenuity. And it requires focus.*



Entrepreneurship

A Curriculum Example



Penn State Engineering Leadership Development Program

Educational Approaches

University educational effects are assessed longitudinally only out to 5 years

Recall, >10 year lag time between completion of terminal degree and enterprise founding

1995 - 2006

What can we provide students with that will last beyond 5 years?

Accounting skills? Business planning?

Recall

Entrepreneurs look at the world through eyes different than most – they see creative opportunities where others see irritations. They capture value through this creative thought.

There is no age constraint on developing this vision nor on practicing creativity and innovation...*and perhaps it lasts longer than 5 years?*

Le Sens Visionnaire



Imagination

Help students see the world differently

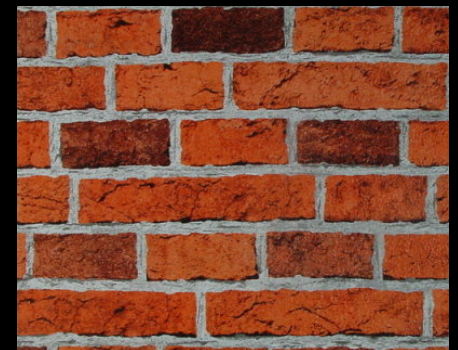
Creativity

Provide the right environment and allow them the opportunity to fail productively

Perspiration and Innovation

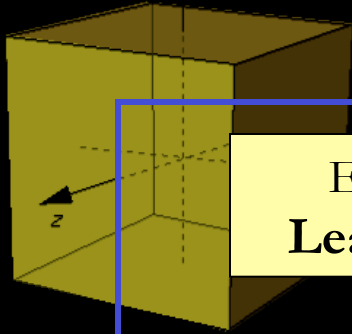
Provide them the opportunity to experience entrepreneurship

Mullah Nasrudin



Overview of 1995 Program

Core Courses (12 credits)



ENGR 408 (2 credits)
Leadership Principles

ENGR 493 (1 credit)
Leadership Practicum

ENGR 409 (3 credits)
**Leadership in
Organizations**

ENGR407 (3 credits)
**Technology Based
Entrepreneurship**

Leadership Capstone (3 credits)
Science Technology and Society

Total number of credits to complete the Minor = 18



Overview of 2012 Program

Core Courses (12 credits)

ENGR 408 (2 credits)
Leadership Principles

ENGR 493 (1 credit)
Leadership Practicum*

ENGR 409 (3 credits)
Leadership in Organizations

or

Global Option *
Global Engineering Teams Seminar (1 credit)
Global Project (2 credits)
International Travel - Hungary (0.5 credit)

ENGR407 (3 credits)
Technology Based Entrepreneurship

Leadership Capstone (3 credits)
Science Technology and Public Policy

or

Global Option *
Global Engineering Teams Seminar (1 credit)
Leadership, Innovation and Global Resource Challenges – Morocco (2 credits)

*** Global options**

Seeds of Entrepreneurship

ENGR407 (3 credits)
**Technology Based
Entrepreneurship**



Global Option *

Global Engineering Teams Seminar (1 credit)
Global Project (2 credits)
International Travel - Hungary (0.5 credit)



Technology-Based Entrepreneurship

Chef Creations

Innovation

Junk Yard Wars

Seeing Potential

Crash N Burn

Experiencing Entrepreneurship

Product/Business Plan Competition

Competing in the Real World

Innovation & You

International Entrepreneurship

ILEAD

International Project Management

Virtual Team Dynamics

Collaborative Multi-Cultural-Disciplinary Projects

Simple and focused value addition (Drucker, Christensen)



CGI 2010

A quarterly journal published by MIT Press

innovations

TECHNOLOGY | GOVERNANCE | GLOBALIZATION

Special Edition for the 2010 Annual Meeting of the Clinton Global Initiative

Build Back Better

Strategies for Societal Renewal in Haiti

Ruins to Riches

Fibers from PET Bottles

Haiti

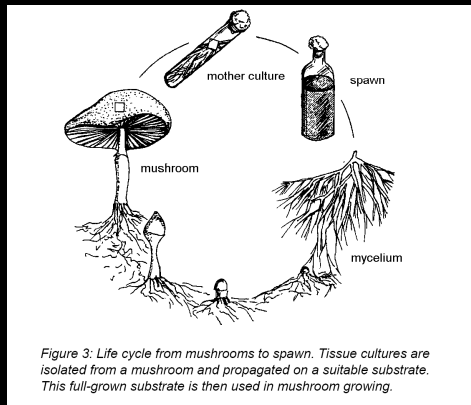
http://web.me.com/iar104/The_Brief/About_Us.html



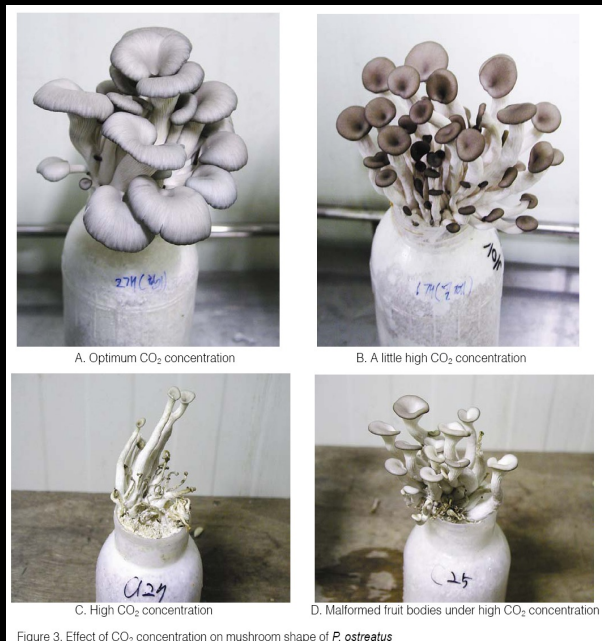
- How to collect plastic and/or incentivize Haitians to collect?
- How to sort, clean, crush into plastic chips (for fabric)?

Mushrooms for Gaza – Food Security

“Futr (mushrooms) for the Future”



- Develop a scientific strategy and financial business plan for a mushroom laboratory
- Develop a scientific strategy and financial business plan for women at-home-cultivators
- Develop a marketable product which suits the needs of the people in Gaza

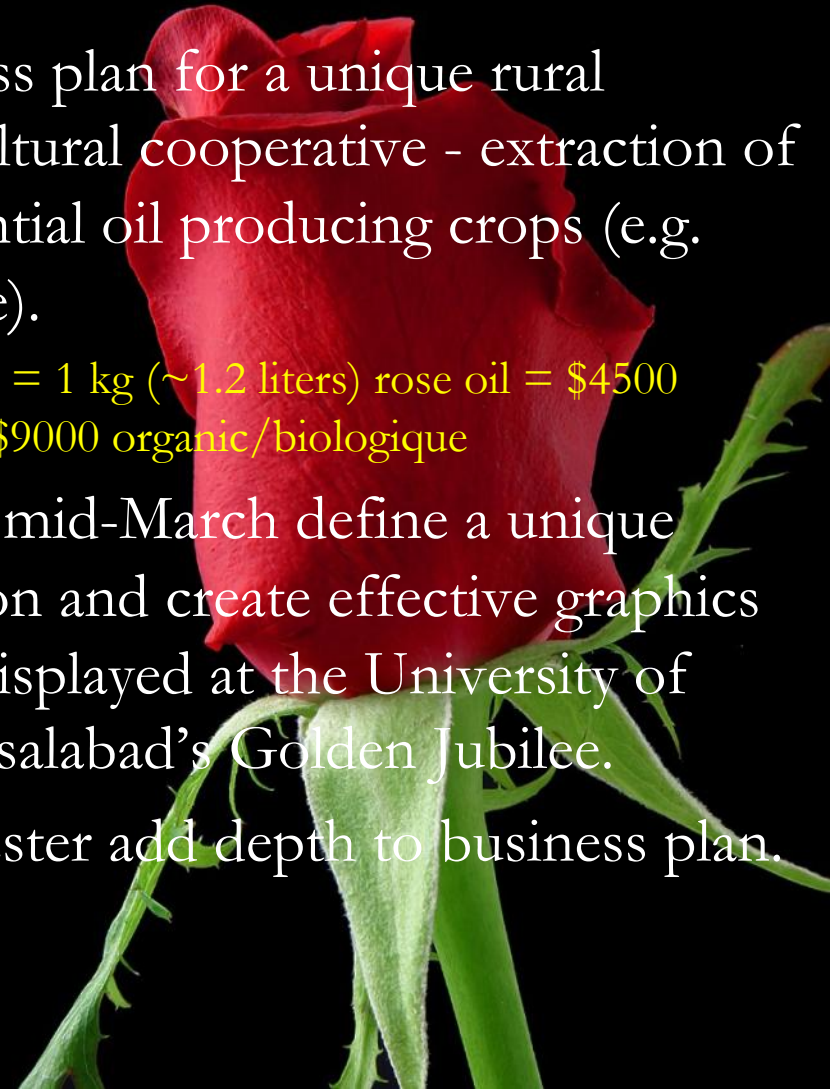


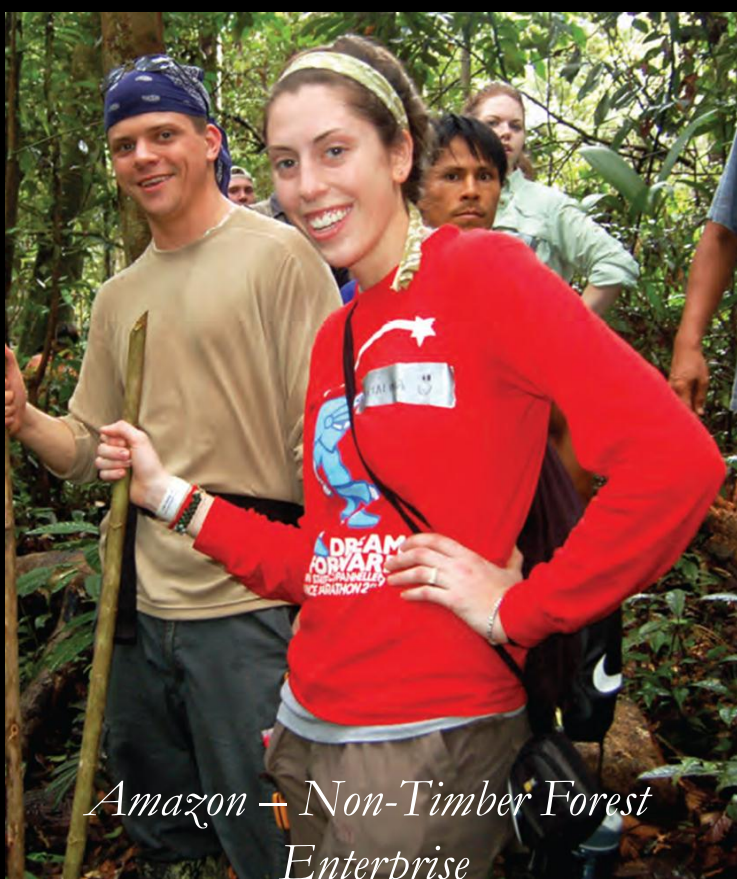
Project Kalaab, Pakistan

Rose oil Cooperative Business Plan



- Create a business plan for a unique rural Pakistani agricultural cooperative - extraction of high value essential oil producing crops (e.g. rose oil, jasmine).
 - 5000 kg of roses = 1 kg (~1.2 liters) rose oil = \$4500 conventional = \$9000 organic/biologique
- Mid-February - mid-March define a unique value proposition and create effective graphics package to be displayed at the University of Agriculture, Faisalabad's Golden Jubilee.
- By end-of-semester add depth to business plan.





*Amazon + Non-Timber Forest
Enterprise*



Sub-Saharan Africa - Food Security Engineering



Morocco - Water Resources Engineering

*“making engineering schools exciting,
creative, adventurous, rigorous,
demanding, and empowering milieus is
more important than specifying
curricular details”*

Questions?