TECHNOLOGY ENTREPRENEURSHIP IN ENGINEERING EDUCATION: HARNESSING THE TECHNOLOGY ENTREPRENEURS IN FILIPINO ENGINEERING STUDENTS

Michelle V. Mancenido
University of the Philippines-Diliman
michelle.mancenido@up.edu.ph

The eventual career path of the young Filipino engineer after college graduation is employment with a multinational corporation. This traditional mindset has been molded over the years through the relentless and aggressive recruitment of MNC’S, which promise large salaries and compensatory benefits to new graduates. Very few, if some, take the less-traveled but admittedly rockier road of starting up their own businesses. The paper discusses the rationale, methodology, and the results of an engineering elective course called Technology Entrepreneurship. The impetus for offering the course is the realization that engineering graduates are fully capable of helping propel the nation to progress through the fruition of technological researches into viable business ventures. The course was designed with two objectives considered: to educate and to inspire. The educational platform offered a full-month seminar on devising feasibility studies for technology-driven or market-driven ideas and researches. This included seminars on marketing, supply chain, and accounting and finance. The “inspirational” platform included encouraging talks by alumni engineer-entrepreneurs who shared their own experiences and valuable lessons gained in start-up businesses. The talks covered areas such as business opportunity recognition, societal and economic awareness, organizational issues in start-ups, and venture capitalists, none of which are covered by the regular engineering curriculum. The full paper shall include a discussion of methodology, execution, results, and feedback on the course.

Introduction

Technology entrepreneurship is the machine that drove the world into the new economy where individuals are known to churn out breakthrough innovations in their own backyards, seamlessly collaborate with colleagues located at the other end of the globe, and make speedy market introductions minus the slow and clumsy decision processes typical of old-world corporations. With the global playing field leveled by information technology, “backyard” technology entrepreneurs became the more significant drivers of the new economy. Alongside Microsoft’s Bill Gates, Google’s Sergey Brin and Larry Page, the famous graduate students from Standford, have become the flag bearers of this ubiquitous new group. With the help of Erik Schmidt, they fostered the growth of the famous internet search-engine from a dormitory concept in 1998 to a $150-billion corporation in 2007 [1].

But even as hundreds upon thousands of technopreneurs deliver breakthrough ideas and innovations everyday, most of them find that it is not easy to do another “Microsoft” or “Google”, as these unfortunate statistics show [2]:

---

[1] Estimated in 2007 United States dollars
Only 1 in 6,000,000 high-technology business ideas wind-up in an Initial Public Offering (IPO)
Less than one percent of business plans received by venture capitalists get funded
Founder Chief Executive Officers (CEO’s) typically own less than 4 percent of their high tech companies after an IPO
60 percent of high tech companies that are funded by venture capitalists go bankrupt

The numbers sum up the efforts of technopreneurial ventures in the United States, but typify the efforts of technopreneurs all over the globe. For a developing country like the Philippines, the issue is not merely in the failure of a technopreneurial venture; it is in the absence or lack of technopreneurial efforts at all. A consultant with a newly-established Filipino business incubator identified that the problem is neither in the absence of new ideas nor in the lack of funding, but in the lack of awareness of what everyone else is doing [3]. In short, the problem is social collaboration.

Engineering students are excellent sources of ideas for technological ventures, but in the Philippines, this well of potential is barely tapped. In a given academic year, the number of student researches in the UP College of Engineering is conservatively estimated at 110. Most of these researches deal with new or improved processes, materials, and products, but only a few are pursued for commercialization. To bridge the gaps present among research, development, and commercialization, the University of the Philippines' College of Engineering offered an elective course to undergraduate engineering students called “Technology Entrepreneurship”. The course had two modules, the “inspirational” and the “technical” module, and was a one-semester offering open to all fields of engineering. The primary goal of the “inspirational” module was to raise the students’ awareness on the potential marketability of their research outputs. The “technical module” aimed to equip them with business and entrepreneurial tools.

This paper presents the rationale, methodology, results, lessons learned, and recommendations for improvement from the offering of an elective technopreneurship course to Filipino engineering students. Similar and identified efforts of educational institutions from the US are discussed beforehand.

What is a Technology Entrepreneur?

Nichols and Armstrong [2003] provided a concise definition of the technology entrepreneur:

*Engineering (or Technology) Entrepreneur.* One who organizes, manages, and assumes the risk of an engineering (or technology) business enterprise.

Esposito and Aggarval [2001] identified career objectives common among technology entrepreneurs:

- *To solve a problem that exists in the market.* The technology entrepreneur is continually looking to fill gaps and niches in the market, whether it be the introduction of a revolutionary product or process, the enhancement of an existing one, or for the bolder, the creation of a new market or industry.
To create long-term value. The technology entrepreneur concerns himself/herself with sustainability. His/her primary goal is to create something with lasting utility, not just to rake in investment dollars. For the technopreneur, creating wealth is a consequence, not a cause of, creating a sustainable effort.

Technology Entrepreneurship in Engineering Education

Technology Entrepreneurship, while a pioneer course offering at the UP College of Engineering, is not a new concept in engineering education. In 2001, General Electric sponsored a minor called E-SHIP at Penn State University’s College of Engineering. The minor was designed to enhance the skills, knowledge, and attitudes necessary for students desiring to become entrepreneurs [4]. The University of Central Florida, in collaboration with the Central Florida Technology Incubator and UCF’s Small Business Development Center, offered a 3-course Engineering Entrepreneurship program with the same goals but with a slightly different approach [5]. The University of Texas at Austin developed undergraduate and graduate courses in engineering entrepreneurship, with the “Lab to Market” as the latest published effort [6]. Similar efforts are reflected in revised engineering curricula worldwide. With the realization that the global competitive field has been leveled by the socio-technological concept of mass collaboration, there is a gradual but dramatic shift in paradigms governing engineering education. Engineering educational institutions are beginning to recognize the need to train young engineers in integrating a value-add component of the technology development process to their basic skills set. Young engineers are not just trained to create the innovation, but to market and package it for commercial consumption.

Technology Entrepreneurship Course at the UP College of Engineering

“The countries with no natural resources tend to dig inside themselves. They try to tap the energy, entrepreneurship, creativity, and intelligence of their own people – men and women – rather than drill an oil well.”

*Thomas Friedman, The World is Flat*

Although abundant in non-petroleum natural resources, the Philippines’ foremost competitive advantage is arguably in its human resource. This fact is evident in the growing number of business processes outsourced to the Philippine shores. While the BPO industry have increased employment opportunities and largely contributed to the Philippines’ marginal economic growth, there is scarcity in outsourced value-adding processes, specifically those related to research and development. With an estimated number of 100,000 students graduating with engineering and IT degrees each year [8], the scarcity in R&D jobs is a manifestation of the collectively low confidence in the employment pool’s capabilities in the field of technology research and development.

It is estimated that the UP College of Engineering produces at least 110 undergraduate and graduate researches per year in various fields of engineering and information technology. Majority of these researches are shelved and archived, and serve best as literature references of future researches, which in turn are shelved and archived, and the loop goes on, until a multitude of studies on a research field only served the purpose of facilitating the awarding of degrees to young engineers. These young engineers, in their time, join the ranks of the corporate-employed, with no further consideration of the researches they had accomplished.
The frustration that resulted from witnessing this trend became the impetus for introducing a holistic course in entrepreneurship, specifically custom-fitted for young engineers, whose outputs are primarily technology-based. The Technology Entrepreneurship course was designed for two primary purposes:

(1) To raise awareness among engineering students of the existence of another option after graduation besides joining the corporate ranks: the option of establishing a technology-driven start-up business. Engineering students are typically unaware that the researches they produce may have potential commercial value if further developed, or that certain companies, organizations, and venture capitalists may be interested in their outputs

(2) To equip the students with tools and skills necessary to develop researches into commercially viable ventures, and to set-up start-up technology-driven businesses

Technology Entrepreneurship Course Methodology

The elective course is a one-semester program offered every second semester by the UP College of Engineering and is open to senior² students of any engineering field, including Computer Science. Only one class of 40-50 students is accommodated into the program every semester. For this reason, interested students are asked to express their intention to be admitted into the program, and are screened before the first semester ends.

Course Modules

The course is comprised of two modules, one dubbed as “inspirational” and the other as “technical”, with each module respectively driven towards the achievement of the two purposes stated earlier.

Successful technopreneurs from various industries were invited as resource speakers to “inspire” student engineers to pursue the commercialization of their research outputs. The profiles of the speakers are diverse and impressive: CEO’s, consultants, business owners, and members of the academe. Majority of the speakers are engineering graduates who had both corporate and business experiences. The speakers discussed the following sample topics in this module:

- Definitions and forms of entrepreneurship
- Questions every entrepreneur must answer
- Opportunity recognition

The second module dealt with the technical know-how in organizing start-ups. Experts in the fields of management and finance were invited as resource speakers. Some topics covered in the second module are the following:

- Forming the new enterprise
- Financing the new venture

² In the Philippine educational system, a senior is a student in his or her 4th or 5th year level of education
• Organizational and human capital development for the new enterprise

The second module went up a notch by inviting a management services expert from the College of Business Administration, who held a relatively long series of lectures on the rigors of the feasibility study.

Course Requirements

A student’s final grade was hinged on the completion of a pre-feasibility study on the commercialization of a research idea or concept produced by the College of Engineering. Prior to the start of the semester, the course facilitator gathered the abstracts of the most recent researches of the different departments in the College. The abstracts were consolidated and disseminated to the students. The students had the option to accomplish the pre-feasibility study on their own researches, or to choose another research in the compilation. The class was divided into groups of 3’s or 4’s in the accomplishment of the project. Groups were a random mixture of students from different departments, and were guided accordingly by the course facilitator and the management services expert from the College of Business Administration. At the end of the semester, each group was tasked to present the results of the study to a panel consisting of the course facilitator, a representative from the College of Business Administration, the Dean of the College of Engineering, and one of the resource speakers.

A final course requirement was a collective class effort, the production of a web log (blog), where each student was required to write about a business or technology-related topic of his or her interest.

Implementation and Results

In the first offering, a total of 75 students originally applied for admission to the program, and 42 eventually enrolled in the course. The number of enrollees per engineering discipline is shown in Figure 1.

![Figure 1. Technology Entrepreneurship Enrollees by Department](image-url)
In the screening process, 81% of the enrollees signified that their reason for enrolling in the course was to gain knowledge on how to set up businesses. When asked as to what extent their business knowledge was before taking up the course, most signified that they had no to little knowledge. Approximately 95% had no business or sales experience.

The students went through the rigors of the different phases of the pre-feasibility study. Consultative sessions were held with the course facilitator and the management services expert present. Both advisers ensured that the students experienced and applied each business or technical tool required in full feasibility studies. Researches involved in the pre-feasibility studies came from the different engineering fields; some dealt with advances in electronics and communications and material innovations. A few of the pre-feasibility studies were comprehensive enough to be considered full feasibility studies. From the 11 pre-feasibility studies produced in the initial offering, 3 to 4 ventures showed high potential.

The final course requirement, the production of a class web log, is still available in the worldwide web:

http://engg197.blogspot.com

A course evaluation at the end of the semester showed that 90% of the students felt they gained much knowledge with regard to starting up a business. Eighty-one percent (81%) signified that they are considering their own start-ups after gaining employment experience. Five percent (5%) are considering their own start-ups immediately after graduation. Almost 100% stated that they are inspired by the resource speakers into developing their own researches into commercial ventures in the future.

**Conclusion and Recommendations**

The technology entrepreneurship course offered by the UP College of Engineering served as an avenue for: (1) learning business and management tools necessary to set up technology ventures (2) raising awareness and network building, where the students had the opportunity to interact with various professionals and realize the potential worth of their research outputs to different organizations and entities (3) a stepping stone in the commercialization of the research outputs of the College.

The program was generally viewed as successful by the enrollees, with 100% recommending the inclusion of the course in future elective offerings. The students voiced out the following recommendations for the improvement of the course:

- Make the course a two-semester program, with more comprehensive training on financial and managerial tools. With the exception of the industrial engineers, none had any accounting or finance-related course included in the curricula
- The feasibility study must span a period of two semesters to allow more time for data gathering and in-depth analysis

Although successful from the viewpoint of execution, the Technology Entrepreneurship course had yet to make an identifiable mark in the career paradigms of engineering graduates. The old-world mentality that the UP College of Engineering
produces engineers who are touted for high-paying jobs with companies should be replaced with the more ambitious vision of producing engineer-entrepreneurs. Lack of researches and lack of funding for commercialization are not the main issues in the scarcity of commercialized technological researches in the College of Engineering. The main issue is the lack of collaboration and awareness. In the same manner that career fairs are held every year at the College to promote and solicit jobs for corporations, a colloquium should be organized to include keynote addresses from venture capitalists, techpreneurs, consultants from incubators, and companies looking for breakthrough innovations. The key is in social collaboration and a change of culture. A course in technology entrepreneurship can lay the groundwork for such intent, but continuity, persistence, and ubiquity of the intent are required to successfully shift the paradigms of the members of the academia.

References

http://money.cnn.com


http://www.bpap.org/bpap/video.asp?video1

Curriculum Vitae