AC 2007-2797: IMPROVING ENTREPRENEURSHIP TEAM PERFORMANCE THROUGH MARKET FEASIBILITY ANALYSIS, EARLY IDENTIFICATION OF TECHNICAL REQUIREMENTS, AND INTELLECTUAL PROPERTY SUPPORT

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Improving Entrepreneurship Team Performance through Market Feasibility Analysis, Early Identification of Technical Requirements, and Intellectual Property Support

Abstract

Choosing the wrong technology—due to insurmountable technical hurdles, market limitations, or resource constraints—can be devastating to a start-up company. Either the company deftly changes directions or it ceases to exist. While experiencing these realities may provide invaluable entrepreneurial life lessons, because of structured academic calendars, course commitments, the requirement for grades, and other factors, it is very difficult to drop a technology or disband a company staffed by students fulfilling university educational requirements.

Many university-based entrepreneurial education centers provide real-world projects for participating students. The University of Florida Integrated Technology Ventures (ITV) program, launched in Fall 2003, is designed to provide engineering, business and law students with an intense, immersive entrepreneurial experience. Participating students are members of a virtual company led by a serial entrepreneur who acts as a volunteer CEO. The focus of the company is to commercialize university intellectual property.

To improve the chances of successfully adopting a new technological innovation and boosting entrepreneurial team performance, we propose an improved way to select suitable technologies, better timing for delivering market-driven requirements to product designers, and enhanced understanding of the implications of business and technical decisions with regards to impact on intellectual property.

Introduction

Life in a start-up technology business is no doubt a rich learning experience. Resources such as capital, facilities, people, and ideas are severely constrained. This environment forces one to adapt quickly or find another activity. While it may not be feasible to replicate all the chaos and pressure associated with such an endeavor in an academic environment, researchers at the University of Florida believe it is possible to come close. The Integrated Technology Ventures (ITV) program provides a conduit for business, engineering and law students to gain valuable entrepreneurial experience developing emerging technologies from the university's intellectual property portfolio. The students work in virtual companies under the guidance of seasoned CEO consultants, university inventors, and business, engineering, and law school faculty mentors.

The ITV program has been in operation since fall 2003. Since that time nine virtual companies have been formed and over 70 students have participated. After the pilot offering, it was recognized that several issues were limiting the overall

success of the ITV program and diminishing the educational value for the student stakeholders. Chief among these issues were the following:

1. The engineering student participants developed their technology deliverables (product design specifications, concepts, detail designs, and prototypes) in parallel with, and frequently independent of, the business team's market research. In other words, design work was completed prior to establishing market requirements. This issue inhibited meaningful exchange of ideas and unnecessarily limited team interdependency.
2. In cases where the technology was discovered to have limited market feasibility (crowded market space, high cost of entry, or small market), the business team tended to disband, while engineering team was stuck with the project since they were enrolled in a 2-semester course.
3. Occasionally the inventor's patent did not cover the technology/prototype ultimately pursued by the engineering team. Without patent protection providing barriers for competitors, the business teams naturally lost interest in the prospects.

To address these issues, the following was implemented:

1. A business development team is commissioned six weeks prior to the start of the fall semester (the engineers begin in the fall) to develop market-driven requirements for the engineering team.
2. Six weeks ahead of commissioning the business development team, graduate students in the business school perform market feasibility assessments on a dozen or so technologies from the university technology portfolio. The ITV Board of Directors then makes final technology selections with a much higher confidence level in the market viability.
3. Patent law students, under the guidance of local patent attorneys joined the virtual companies to assist in research on prior art, patentability, and freedom to operate issues.

ITV Summary

The Integrated Technology Ventures (ITV) program, launched in Fall 2003, is designed to provide engineering and business students with an intense, immersive entrepreneurial experience. Participating students learn the entrepreneurial process as members of a virtual company led by a serial entrepreneur who acts as a volunteer CEO. The company is composed of a CEO, a business development team of several MBA students (coached by entrepreneurial faculty) and a multidisciplinary technology development team of 6 undergraduate engineers (coached by engineering faculty). The technologies under development are selected from UF faculty inventions ready for commercialization. The faculty inventor serves as an extended team member for the virtual company. The CEO leads the company in the creation of an alpha system prototype and collateral materials such as a business plan and presentation for entry in academic business plan competitions.

The engineering students from each virtual company are selected from a pool of students participating in the highly successful Integrated Product and Process Design (IPPD) program (Stanfill 2001) (Stanfill 2002) (Fitz-Coy 2002) (Stanfill 2003). IPPD is a 2-semester program where undergraduate students from various disciplines are taught how to design products and processes. Then, working in multidisciplinary teams under the guidance of faculty coaches and company liaison engineers, the students design authentic products for industry sponsors. More details are available at the IPPD web site (http://www.ippd.ufl.edu). Business student participants in the ITV program are drawn from various undergraduate and masters degree programs offered through the Center for Entrepreneurship and Innovation (CEI). Many of these students learned the basics of business plan development through the NCIIA-sponsored Technology Venture Sequence, Technology Venture Academy, or Invention to Venture (I2V) workshops. More information about CEI and its various programs such as Gatornest, are available from the CEI website (http://www.ufventures.com). Details of the ITV program structure, pedagogy and other program aspects are described in detail in the references (Stanfill et al NCIIA 2004) and (Stanfill et al ASEE 2004).

Three pilot entrepreneurial teams chartered in the initial offering completed their projects in spring 2004. Funding for these companies was secured through the Economic Development Administration, the Lemelson Foundation (via the National Collegiate Inventors and Innovators Alliance), and the University of Florida. A board of directors was formed to oversee the direction of the ITV program and serve as the board for each virtual company.

Seven virtual companies have completed their 2-semester entrepreneurial cycle, with two current virtual companies. Of the seven, three placed first in the Howard J. Leonhardt Business Plan Competition with one runner up finish. Two teams were finalists in the Wake Forest Elevator competition and one team was a finalist in the Moot Corp competition. One of the pilot ITV teams resulted in a successful start-up company, EnviroFlux. Three others have been been licensed or are in the process of being licensed.

ITV Shortcomings

Company success in the first and subsequent offerings of the ITV, independent of student and management team capability, was largely dependent on selecting the right technology for development, providing timely, market-driven requirements to the design team, and having strong patent protection in place. The following sections describe how the technologies were selected for the projects, the process by which market-driven product requirements were communicated from the business development teams to the engineering teams, and how intellectual property issues were handled.

Technology Selection

Technologies for ITV project consideration all originate from the University of Florida intellectual property portfolio. For the first three years of operation, the

ITV board of directors, in consultation with university licensing officers, screened potential technologies based upon suspected market potential, scalability of the technology for undergraduate engineers, commercialization readiness, and willingness of the inventor to participate. The selections occurred in the summer prior to a fall company formation and kickoff. As selections were made, CEO candidates were brought in for interviews.

While the board is composed of a diverse, intelligent group of professionals, the ultimate decisions on whether to include a technology were frequently based upon the gut and not data. Reliance on gut instincts has led to technology selections that were either too early stage or in a saturated market. Either of these conditions spells disaster for the business development teams. The following summarizes why:

1. For the first three ITV offerings, business students participating did so for experience, since course credit was not available to them
2. Incentives for the business teams include the possibility for winning cash in academic business plan competitions
3. Early stage technologies and those technologies trying to make it in a crowded market are less attractive to investors
4. Investors make up a significant portion of the judges for business plan competitions
5. If the technology is not attractive to investors, then the business plan has a low potential for winning a prize
6. Putting together a business plan is a lot of work, and if the plan has a poor shot at winning, then the effort can be seen as wasted

Therefore, it is crucial to create a more data-driven technology selection process. Better technology selection improves retention of business team participants. For example, in the pilot ITV offering, a device to strengthen respiratory muscles was being commercialized. The device was promising for musicians, vocalists and for certain therapeutic applications; however, for performance athletes, it only provided marginal benefits. Due to the niche nature of the market and the expected price point for musicians and vocalists, the outlook for high volume sales was low. The engineering team did complete a nice working prototype, but the business team effectively disbanded, declining to create a business plan for entry into business plan competitions.

Market-driven Product Requirements

Common industry practice is to commission product design teams after market-driven product requirements have been developed by a marketing team. In the first three years of the ITV program, this arrangement was not possible because the business development team and engineering development teams were commissioned at the beginning of the fall semester. This timing immediately put the business team out of phase with the engineers. The engineering teams, all participants in a two-semester product development course, were required to meet

a rigorous set of project deliverables and always had to develop product specifications and concepts well ahead of business team's ability to collect market data and provide product requirements.

Eight weeks into the fall semester, the engineering team typically would be heavily invested in a particular product architecture and implementation path. Often this path would be contrary to the business team's market findings. Further, the engineering team's choices tend to be based upon the discipline mix on the team as opposed to the choices backed up with market data. The engineers also must conceive and fabricate a working prototype as a proof of concept to meet academic requirements for the course they are registered in. The business team, on the other hand, begins work on a business model and plan based upon a "to be" state. For example, the engineering team works out a design for ventricular assist device (VAD) prototype to be used in clinic trials with pigs, while the business team writes a business plan for a VAD small enough for pediatric applications. The business team can provide many aspects of voice of the customer to the engineers; however, the engineers will filter out what they need for their prototype.

The bottom line is that if an engineering team has a strict schedule of technical deliverables to meet and the business team does not have a head start on market-driven product requirements, the business team will always lag and cross-fertilization between teams will suffer resulting in a dysfunctional company.

Intellectual Property Issues

A recent ITV company developed a time-temperature integrator for predicting the remaining shelf life of perishables. The intellectual property dealt with the predictive algorithm. The engineering team developed a wireless device with a temperature sensor, data logger, and the predictive algorithm. Investors were interested in the device, but there were many competitors and no overwhelming value proposition for this new algorithm. Further, the patent only protected the algorithm and not the device (protected under competitor patents). As the details of the limited intellectual property (IP) became apparent, the business development team began to disappear. Had the IP been explored prior to ITV company launch, it is likely this technology would have been avoided. This scenario indicates the need for early and frequent interaction with IP attorneys to avoid committing resources for limited returns.

Enhancements to Improve Team Performance

Three major changes were made to the ITV program to improve the performance of the entrepreneurial teams. So that better, data-driven decisions could be made in the process of selecting appropriate—"hot"—technologies, teams of graduate level business students researched technological innovations in the University of Florida IP portfolio and produced recommendations for the ITV board to consider. To provide more timely market-driven requirements for the engineers, the business development team is commissioned 6 weeks prior to the product development launch. As a further incentive, business students now receive course

credit for participation (including MBA students). To improve the understanding of IP issues (prior art, nondisclosure agreements, patentability, and freedom to operate), a patent attorney was added to the ITV board of directors and IP-track law students are now part of each virtual company. The following explains each of these improvements in more detail.

Technology Selection From Market Feasibility Analysis

At the start of each summer term, twelve potential ITV technologies are passed along to GatorNest teams to evaluate market feasibility. GatorNest is a business planning service provided by the University of Florida Center for Entrepreneurship and Innovation. Student volunteers enrolled in various entrepreneurial degree programs at the undergraduate and masters level gain valuable experience assisting established and start-up companies solve a variety of business problems.

The market feasibility analyses performed by the GatorNest teams are facilitated by experienced entrepreneurial faculty following a disciplined process. The process requires interviewing the inventor and other stakeholder, plus researching competitive products and technologies. At the end of six weeks the GatorNest team provides a detailed report summarizing each technology and recommended disposition. The report features a Technology Assessment Summary (see Table 1) and Risk Assessment Questionnaire (see Table 2).

Based on GatorNest team's findings and ITV board's collective experience, two high-potential technologies are selected for further study or for staffing. This methodology was first tried in summer 2006. Anecdotal response from the ITV board was extremely positive. The feasibility studies made it easier to select the final technologies for further study and attract external entrepreneurs to lead the virtual companies.

Table 1 Key elements of the ITV Technology Assessment Summary

Element	**Possible ratings**
feasibility of this technology being able to be produced or licensed for profit	High, Medium, Low (pick one)
Competitive Advantage	This technology … Is less expensive than existing technology Performs better than existing technology Performs faster than existing technology Is easer to use than existing technology There is no competing technology None of the above (circle all that apply)
Overall Recommendation	Continue research. Move on to Market Analysis. At this time, do not proceed with development. (pick one)

Table 2 Key elements of the ITV Technology Risk Assessment Questionnaire

Element	**Considerations**
Primary Tests	Competition Market
Secondary Tests	Technology Commercial
Tertiary Tests	Project Scope Schedule (time to market) Other Business or Organizational Impacts Performance

Early Start on Market-driven Product Requirements

Starting early is the key to having market-driven product requirements available just in time for the engineering team. Starting in 2006, the business teams, composed of Master of Science in Management (MBA) students, were commissioned six weeks prior to the start of the fall semester. With this head start, the business teams are now able to do focused research on the market, the competition, and key legal issues before the engineering team is formed. The team works under the guidance of a business team mentor ("coach") and ideally the

CEO (now also hired earlier in the process). During the fall 2006 project kick-off with the engineering teams, the business teams were able to effectively brief the engineers and the ITV board with a comprehensive understanding of the technology's market potential.

During fall 2006, the Warrington College of Business approved MBA student credit for participation in the ITV program. The MBA students typically have several years of professional experience and tend to outperform the MSM team members. The expectation for the 2007 ITV is that the quality of the business plans will improve dramatically.

Integration Intellectual Property Law Students

Beginning in fall 2005, IP track law students were integrated with the business and engineering teams. Due to a late start, this integration did not make a large impact on the performance of the two ITV companies. The law students did train the rest of the company on proper techniques to maintain patent notebooks, how to utilize non-disclosure agreements, and issues related to patentability and freedom to operate. The law teams are supervised by local patent attorneys who are adjuncts at the law school. The attorneys also support these students with internships and provide their opinions and services to the ITV program as an in-kind donation. The law students wrote the IP-related sections of the business plan for the team that entered (and won) the Howard J. Leonhardt Business Plan Competition.

For the fall 2006 ITV program, law students were integrated from day one with engineering and business teams. The students participate in the weekly CEO-led company meetings and as-needed with the engineering and business teams. The IP-related training occurred several months ahead of the previous year's training. It is expected that the law students will have a major impact on the quality of the business plan and investor presentations.

Conclusion

The University of Florida Integrated Technology Ventures program was moved from concept to implementation in less than six months. Since its inception in 2003, the ITV program has been steadily improved. Early on it was discovered that improvements were needed in the way technologies were screened and selected for inclusion in the program. It was also recognized that the business teams need to start ahead of the engineering teams so that market-driven product requirements could feed the product design activity. And lastly, inconsistencies in the handling of, and a lack of understanding of IP-related issues hindered the performance of the entrepreneurial teams. The recent introduction of three major initiatives was targeted at addressing these concerns. First, a formalized market feasibility phase was introduced to promote data-driven decision making during the technology selection. Second, the business teams are now commissioned 6 weeks ahead of the engineering teams, providing timely market requirements data during product concept generation activities. And lastly, IP-track law students are now part of every entrepreneurial virtual company.

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