AC 2012-5372: A MODEL FOR STIMULATING INDUSTRIAL PARTICIPATION IN UNDERGRADUATE ENGINEERING PROGRAMS: 12 YEARS OF ROSE-HULMAN VENTURES

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Mitch Landess serves as the primary point of contact for external organizations who wish to engage Rose-Hulman Institute of Technology through the Rose-Hulman Ventures (RHV) program. Landess is responsible for the business development function at RHV; initiating new client relationships, negotiating engineering contracts, and directing programs of projects where teams of faculty members, project managers, engineers, technicians, and interns develop new products for RHV clients. Landess earned both his B.S. and M.S. degrees in electrical engineering from Rose-Hulman Institute of Technology. He has 16 years of work experience. Landess's industrial background is alternative fuel gasification, cryogenic air separation, and power generation. His technical areas of expertise include process optimization, automation controls, and data acquisition for industrial process equipment.

A Model for Stimulating Industrial Participation in Undergraduate Engineering Programs: 12 Years of Rose-Hulman Ventures

Abstract

Rose-Hulman Ventures is a program at the Rose-Hulman Institute of Technology where students work as paid interns on engineering projects supplied by commercial clients. Based upon the needs of the clients, multi-disciplinary student intern teams are assembled for each project and are led by full-time experienced engineers. Most project engagements are on fee-for-service basis with typical fees ranging from $50,000 to $100,000. Since the program was started in 1999, it has employed more than 880 student interns working with 144 client companies. This paper describes the Rose-Hulman Ventures' operating model, the facilities and staffing for the program, and the impact the program has had on the student interns, the client companies, the university and the regional innovation ecosystem.

Introduction

The program started in 1999 and focused on three activities: providing engineering services for companies, making investments in early stage technology based companies, and providing incubator space to small start-up companies. The overarching objective of these activities was – and continues to be- providing outstanding educational experiences. The opportunity for student participation in the program is provided through the engineering services activities and is the focus of this paper.

The students work on projects for the client companies as paid interns. Typically there are approximately 25 client companies engaged with the program at any point in time with a total of 50-80 interns working on engineering projects for those companies. The investment and incubator activities are largely used as mechanisms to help attract companies that can provide meaningful projects for our students and to help sustain the program. Since the inception of the program, more than 880 student interns have worked with 144 client companies.

The infrastructure in place to support the program includes a staff of 14 individuals and a building located five miles from the main campus. The majority of the staff members are technical project managers. These project managers are degreed engineers with industrial experience and are not members of the university faculty. They hire and manage the student interns, help develop the proposals that are presented to potential clients, ensure that the needs of

the client companies are met, and educate the interns both with respect to technical matters and also with respect to the norms of professional practice. The program also employs additional technical and administrative staff. The technical staff maintains the equipment and provides general technical support. The administrative staff recruits new clients and administers the program.

The program is located in a 35,000 ft^2 building that is equipped with an electronics shop, a machine shop, an IT infrastructure and an assortment of rapid prototyping equipment (e.g. waterjet cutter, polyjet rapid prototype and laser welder). The facility and the equipment have been configured to accommodate a wide range of engineering projects as opposed to focusing on a particular technology or industry.

Figure 1: Aerial view of the building that houses the program.

Operating Model

The engineering services portion of the program operates on a fee-for-service basis. Four different fee-for-service billing models have been used: time & material, subscription, fixed-fee and cost-plus. Given the unpredictable nature of the development projects that are performed, time & material billing has proven to be the most successful and the majority of projects are now engaged through time & material contracts. In that arrangement, the client is invoiced monthly for the cost of materials plus the direct labor. The direct labor hours applied to a project are tracked and billed against four different labor categories: student interns, technical staff, project managers and faculty.

The student interns work on the projects for pay and do not receive academic credit. Administratively, a student intern reports to the program, but he or she receives work direction from the client company and the project manager. The student interns are limited to approximately 10 hours/week of effort during the terms that they are taking classes. They are

expected to work 40 hours/week during the terms they are not taking classes, which is generally during the summer. The building is maintained as a professional work environment with traditional business operating hours. The student interns are expected to dress and behave accordingly and maintain a schedule that is negotiated at the start of each term.

Since the student interns are working for pay as opposed to credit, it's possible to de-couple the start and end of projects from the traditional academic calendar. This offers the advantage of being able to quickly respond to the needs of the client and has helped attract clients that would not have been able to adjust the timing of their needs to the academic calendar. Additionally, having the student interns work for pay as opposed to credit, allows the program to quickly and decisively respond to the rare situation where a student intern is not meeting expectations of the client or the program.

Before any project work is started, an R&D agreement is negotiated and signed. Some of the important elements addressed in the agreement are compensation, intellectual property, confidentiality, indemnification and limitation of liability. One of the distinctive characteristics of the program is that no attempt is made by the university to extract revenue from the intellectual property that is created as part of the projects. In general, any intellectual property that is created during the execution of the project is assigned to the client company. This characteristic has proven to be a differentiator and has helped to attract clients to the program. Other aspects of the agreement that are given much attention are the indemnification and limitation of liability elements. Strong language is included in the agreement to isolate the university from any liability associated with the products and processes that are created as part of the projects. Some potential clients have found this language objectionable. However, the program has stood firm on this issue. We believe that this is the right course of action for the program and the university, but potential clients have been lost over this issue.

Projects

Most projects that are pursued as part of the program are early stage product development and prototyping projects that don't fit neatly into the operational models of the traditional participants in research and development. Figure 2 shows three of the traditional participants in the research and development community along with where they typically exist in the continuum of R&D commercialization activities. These participants are traditional academic researchers, commercial third party product development companies and corporate R&D organizations. We have found a successful niche working on projects that are more applied in nature than what is pursued by traditional academic researchers, but yet are less defined than is generally a comfortable fit for commercial third party product development companies or corporate research and development organizations.

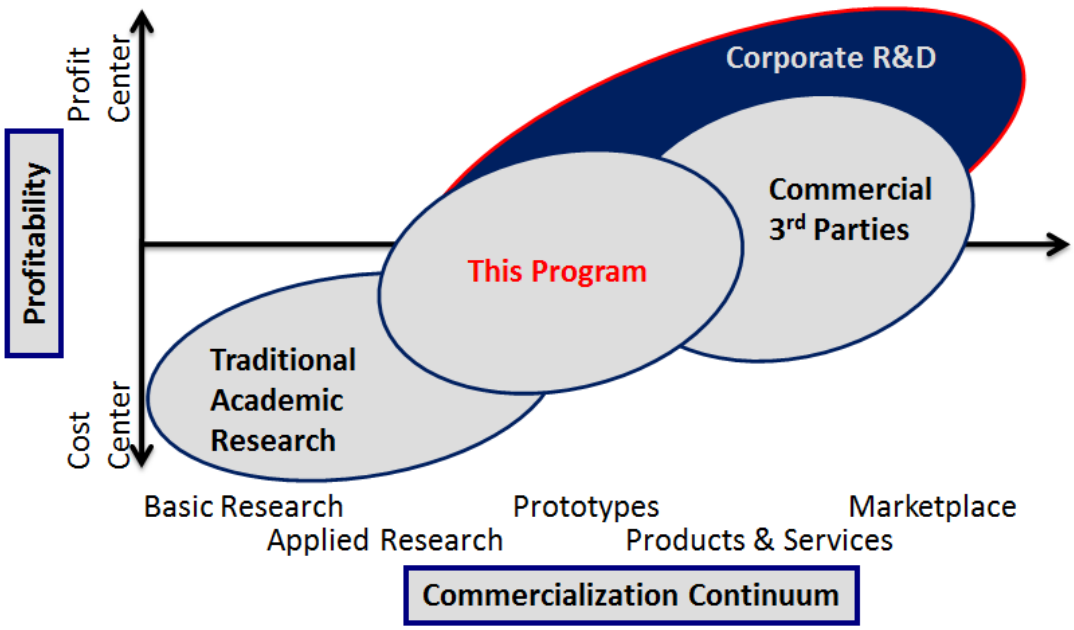

Figure 2: Positioning of the program in the technology transfer community.

An example is a device that we are developing with a client that is a small medical technology start-up company, FAST Diagnostics, Inc. FAST Diagnostics is developing a device to quickly provide a quantitative measure of kidney function. The scientific work that forms the foundation of the device was performed by talented researchers at the Indiana University School of Medicine.

The basic operating principle is that two materials are injected into the bloodstream of the patient. One of the materials is filtered by the kidney while the other is not. An optic fiber is placed into the bloodstream and is used to measure the ratio of these two materials over time. From this ratio, it's possible to generate a quantitative measure of kidney function, the glomerular filtration rate, in less than one hour. Current clinical approaches to obtain the same measure requires that blood samples be sent to a lab and can take approximately 1 day to obtain the results.

An entrepreneur recognized the market potential for a clinical device based on this research. However, as developed in the laboratory, the technology was too complicated and expensive for broad clinical acceptance. Rose-Hulman Ventures provided the venue for exploring different options for productizing the technology and building functional prototypes for the clinical setting. This project required multi-disciplinary teams with student interns drawn from biomedical engineering, optical engineering, mechanical engineering, electrical engineering,

computer engineering and computer science. The devices that have been developed have undergone extensive animal testing and are showing promising results.

Stakeholder Impact

The four major stakeholders for the program are our student interns, the client companies, the university, and the regional innovation community. More than 880 student interns have participated in the program. They have benefited from the program in several ways including the technical experience, a well-paid part-time job, gaining insights into the context in which engineering is practiced, and an introduction to the norms of behavior within the practice of the engineering profession. Surveys of the student interns suggest that the experiences have been well regarded by the student interns. During each of the past four summers, the student interns were surveyed to gain insights into their perception of the program. The aggregate results of those surveys show that 93% of the student interns had a positive overall experience, 99% of the interns would recommend this opportunity to their colleagues, and 94% of the interns believed that the internship helped them to fulfill their career goals.

Since the inception of the program, the program has worked with 144 client companies. These companies have ranged from small early-stage startup companies to large multi-nationals. For these companies, the program has provided solutions to their technical needs and a mechanism for recruiting talented students. It has also provided a way for companies to have a positive impact on engineering education by giving them a way to participate in the undergraduate engineering education enterprise.

Two of the benefits realized by the university include building stronger relationships with the companies that ultimately employ our students and providing professional development opportunities for the faculty and staff. The program has also proven to be an effective recruitment tool. As part of a survey that was administered to all freshmen entering in the fall of 2011; the students were presented with a list of academic extracurricular programs and were asked which programs had a positive impact on their decisions to attend Rose-Hulman Institute of Technology. Twenty-one percent of the respondents indicated that Rose-Hulman Ventures has a positive impact on their decision to attend Rose-Hulman.

Economic impact on the regional innovation community is best described through example. Suros Surgical Systems, Inc was a startup company in 2000 with only 3 employees. Suros was intent on developing a fully automated, minimally invasive, tissue removal system for treating breast cancer. Suros raised capital through traditional means in the investment community but they also partnered with Rose-Hulman Ventures to develop early versions of the product. The program provided development services to Suros as an ‘in-kind’ investment. The product was

launched within 18 months. By 2006 Suros had grown to 140 employees before being acquired by Hologic, Inc for $240 million. The program has continued to work with Hologic. Approximately 50 students have been involved with development projects with Suros and Hologic to date.

The founders of Suros moved on in 2007 to start another medical device venture within the region, NICO Corporation. They again partnered with Rose-Hulman Ventures on device development. Their first product, a brain surgery tool, was launched in 2009 and continues to gain market share. Approximately 26 students have been involved with development projects with NICO to date.

Conclusions

A program has been introduced that provides one example of a model for collaboration between a university and industrial partners. The operating model is based on a fee-for-service structure for early stage product development and prototyping projects. The program has been in place for 12 years providing internships to over 880 students and working with 144 companies. The program has had positive impacts on the student interns, the client companies and the university.