AC 2008-25: GROWING AN ENGINEERING MANAGEMENT PROGRAM: CONCENTRATION AREAS FOR THE FUTURE

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Growing an Engineering Management Program: Concentration Areas for the Future

Abstract:
There has been recent growth in undergraduate Engineering Management (EM) programs in the United States., From 2003 to 2006 the number of Accreditation Board of Engineering and Technology (ABET) accredited EM programs has grown from three to five: Stevens Institute of Technology, NJ; was the second ABET accredited program in the United States; getting accredited in 1992. The growth Stevens has experienced in its undergraduate EM program since its inception has been gradual and anticipated. However, since 2003, the recent upsurge in growth has been exponential and future anticipated expansion in the available programming has led to the creation of focus areas or concentrations within the overall Stevens' EM program. The purpose of the addition of these concentrations is two fold: to allow the students to more closely align their interests with their courses and to attract more students to the EM field in general. This paper provides guidance to the expansion of one of the oldest EM programs in the country by examining the experiences and processes at Stevens Institute of Technology during its creation of the concentrations within its existing EM Program.

Introduction

Despite steady growth in undergraduate Engineering Management (EM) programs in the United States, until 2003 only three EM programs were accredited by the Accreditation Board of Engineering and Technology (ABET): Stevens Institute of Technology, NJ; United States Military Academy, NY; and the University of Missouri Rolla, MO. But recently, there has been an upsurge in accreditation activity. In 2003 the University of Pacific was successfully accredited and Arizona State University was accredited in 2005. This is not mentioning the growth within these programs or the growth in other, not yet accredited EM programs across the country. Although there are 5 ABET accredited EM programs, there are estimated to be between 12 (Farr and Bowman) and 27 (Abel and Fernandez) EM undergraduate programs across the United States and each of these programs appears to be growing as evidenced by increased enrollments. (See for example, WestPoint growth in enrollment over 2003 – 2008.) (Trainor)

This paper provides guidance to Engineering Management programs considering expansion, by examining the experiences and processes at Stevens Institute of Technology. The paper first provides population and background on the EM program at Stevens. This is followed by a description of the Engineering Management program and its experiences and processes while implementing its new concentrations within Engineering Management. And the paper concludes with benefits of successfully implementing an expansion through focus areas or concentrations.

Population and Background of EM Program

Stevens Institute of Technology is a private university located on the banks of the Hudson River across from Manhattan, in Hoboken, New Jersey. The EM Program at Stevens was first ABET accredited in 1992, and successfully re-accredited in 1998 and 2004. The EM

program at Stevens is housed in the School of Systems and Enterprises and is relatively large, and well established. The success of the EM program is evidenced by the size of its faculty (15 full time faculty) and external recognition (seven awards from the American Society of Engineering Management, ASEM since 2000). Of the 15 faculty in the EM department, 10 currently teach in the undergraduate program. And of these faculty, several have been members of the American Society for Engineering Management (ASEM) for over 5 years. Stevens has approximately 1500 undergraduate students, of which about 110 designated Engineering Management (EM) as their preferred discipline in the 2007 – 2008 academic year. Approximately 50% of Engineering Management students choose to participate in the five year Cooperative Education program. Stevens graduates between 20 and 30 Engineering Management students a year with a Bachelor of Engineering Degree. Approximately 85% of these EM graduates have a job prior to graduation with an average starting salary of $55,600. Tracking the initial employment figures of the Engineering Management graduates since 2000 showed that over 50 percent of EM graduates either become analysts or enter the IT/Systems field. Knowing that a majority of Stevens Engineering Management graduates do not follow the typical path into traditional engineering, creating focus areas specializing in the career path of over half the graduate EM population was deemed appropriate and necessary to serve the undergraduate Engineering Management population well.

Summary of Successful Endeavors and Challenges

Stevens Institute of Technology had no concentrations in the Engineering Management Program since its inception in the late 80's. However, other more established programs, such as Mechanical Engineering, which has been at Stevens since its inception in 1870, had many concentrations. Using Mechanical Engineering as a model, and discussing ABET requirements for concentrations with Mechanical Engineering, led to following a similar model within the Engineering Management Program. For example, note that due to ABET regulations only 400 and 500 level courses may be listed within concentrations.

To determine the best concentrations to pursue within the Stevens Engineering Management Program, two concepts were used. First, investigation into other existing Engineering Management programs showed Systems Engineering to be a highly compatible focus area. Second, was an investigation into Stevens' own areas of expertise.

As mentioned, the Engineering Management Program is housed in the School of Systems and Enterprises. Thus, within our domains of available expertise are Systems Engineering and Engineering Management. Therefore, we investigated the strengths within these graduate programs: the purpose being to leverage these strengths into the undergraduate program. Thus, for the 2008-2009 academic year catalog only two concentrations within the EM program were considered for pursuit: Systems Engineering and Financial Engineering since these were the School's strengths. It was decided that more than two concentrations at this point would be overtaxing to the EM program and faculty. This was assumed since in the student's senior year, the concentrations would in essence split the senior class in two sections reducing the number of students per

concentration/course to approximately 15 per class and therefore doubling the course offerings by the Program. In the future, more concentrations will be considered if increased enrollment in the EM program warrants the additional courses.

There were several changes necessary to complete the movement to concentrations. Most importantly, two courses would be removed from the standard EM curriculum in the senior year. The courses to be removed from the standard curriculum would be EM 457 (Elements of Operations Research) and EM 435 (Business Process Reengineering). These two course slots would now be called "Technical Electives". These two "Technical Elective" slots would need to be filled by two of the three courses listed below under the specific concentration of the student's choosing. The third course under the concentration would take up a "General Elective" slot in the student's general engineering curriculum. As mentioned, this format is based on the standard format for concentrations used in the existing Engineering Programs in the School of Engineering at Stevens Institute of Technology. It should also be mentioned that difficulties were encountered with this change in curriculum as various faculty had differing opinions on what classes should be removed and which should be added to the existing Engineering Management curriculum. Group discussion at meetings, as well as intense email exchange, among EM undergraduate teaching faculty eventually led to a consensus among the faculty.

The concentrations were therefore set up so students can select their concentration elective courses among two technical electives and three general electives in various ways. Some of the students may wish to cluster those electives in ways that would help them gain expertise in an area of specialization within Engineering Management. The following groupings are the concentration areas, and courses within those areas, that students can select from within the Engineering Management program starting in the 2008-2009 academic year:

Systems Engineering Concentration

EM 457 Elements of Operations Research (fall)
EM 435 Business Process Reengineering (fall)
SYS 5xx Introduction to Systems Engineering (spring)

Financial Engineering Concentration

EM 457 Elements of Operations Research (fall)
FE 510 Introduction to Financial Engineering (fall)
FE 5xx Pricing and Hedging with Probability and Stochastic Calculus (spring)

Benefits of Having Concentrations within the Engineering Management Major
As the Engineering Management Program is growing, the need for larger course sections or the splitting of large course sections into two sections is becoming obvious and necessary. This requirement was used to the EM Program's advantage by widening our offerings and therefore widening the appeal of the EM degree to others who may not have considered EM prior to the areas of concentration being added. Thus, it is the hope

of the EM program that as EM grows now, so shall the Program grow further in the future due to these increased course and focus area offerings that shall happen in the near future.

Insights

Engineering Management departments continue to draw more and more students because of the quality of the EM education, the competitive edge of graduates in the job market and the relevance of the EM curriculum to real world work related activities. Yet notwithstanding this relative success, students and practitioners are sometimes unaware of this discipline or, worse yet, misunderstand the objectives and outcomes of an EM education. Adding concentrations to existing EM undergraduate programs may help to reduce this obstacle, as concentrations will give Engineering Management students an area of focus which they can highlight in employment and other EM related discussions.

Conclusion

Instituting concentrations within an existing Engineering Management Program requires a standing commitment of resources by the faculty of the Program and the Program itself. As more classes will need to be developed to create the concentrations and larger enrollments are expected due to the greater reach, resources would need to be set aside and applied as growth and maturation within the Program occurs. Successful implementation of concentrations results from institutionalizing processes and leveraging knowledge resources that cut across the many constituencies and activities of the School of Systems and Enterprises. Determining the strengths of the School and pooling the resources may take time to develop and sustain. However, the benefit of concentrations can be substantial for the Program involved, as it typically leads to increased student enrollment, greater institutional funding, facilitated attraction of superior faculty, and increased future employment opportunities for graduates. This paper identifies and discusses the major attributes that contributed toward the implementation of two new concentrations in the EM program within the School of Systems and Enterprises at Stevens Institute of Technology. The experiences and approaches highlight the potential for any type of EM program to achieve successful implementation of concentrations in similar concentration areas.

If Engineering Management is to successfully compete for undergraduate students and be acknowledged as a growing academic program, it must strive to create a critical mass of focus areas at diverse institutions throughout the country. Concentrations may provide the structural framework allowing this to occur.

Bibliography

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