2006-35: ASEM ESTABLISHES STANDARDS FOR MS PROGRAMS IN ENGINEERING MANAGEMENT, ESTABLISHES CERTIFICATION PROGRAM

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ASEM Establishes Standards for MS Programs in Engineering Management Through Its Master's Program Certification

Abstract
The American Society for Engineering Management (ASEM) studied masters programs in engineering management. They found over one hundred such programs and the numbers are growing. It was also found that there are significant differences among and little commonality in those programs. With this information, ASEM has moved to provide a standard framework for this degree for guidance to new and existing programs with a flexible template to guide program development and change. ASEM also created a certification plan so that programs that meet the established standards can be identified to students and employers as having met a national benchmark.

Background
For the past twenty seven years, the American Society for Engineering Management **(**ASEM) has been promoting and defining the discipline of engineering management. ASEM membership is comprised of representatives from academia, government and industry. Although there are some notable undergraduate programs and several doctoral programs in existence, most EM programs are masters programs. Farr and Bowman[1] (1999) identified over one hundred master's programs in engineering management. As the number of programs continues to grow, so does the enrollment in those programs. Even with growth, engineering management, as a discipline, is relatively unknown in the academic community. There is little agreement on the content of engineering management programs. Hicks et. al.[2] (1999) found three different curricular groups in existing engineering management master's programs. These curricular types are described below.

Program Administration
Further examination revealed two dominant forms of program administration. The appeal of Engineering Management (EM) is that it has the potential of generating revenue without the commitment of scarce university resources, particularly faculty. Thus, EM can become an academic cash cow that builds university good will and generates needed financial returns.

Other universities take an entirely different approach. Engineering Management is viewed as an important academic discipline with knowledgeable faculty members who are doing a significant amount of sponsored research and contributing to engineering journals. These universities are concerned about the approach described above and feel that it is a threat to the discipline. The universities that are taking a more serious approach to EM think that EM growth in knowledge parallels the growth of technology. They further feel that expansion of the EM knowledge base is necessary to manage expanding technology. Yet, even these universities do not have a unified view of EM and their academic programs have significant differences.

The Three Faces of Engineering Management
The Hicks et. al.[2] (1999) study classified EM masters programs into three curricular groups. One group focused on classical management concepts- planning, marketing, accounting, etc. The second group focused on mathematical concepts- operations research, probabilistic models, linear

programming, etc. and the third focused on behavioral management- motivation, project management, leadership, etc. This research found that there was no agreement on the type of courses that should be in EM programs. Some of the EM programs were formerly existing programs in Operations Research or Industrial Engineering. The lack of agreement of program content allows any university or private company to define EM independently.

The American Society of Engineering Management (ASEM) was presented with this information and realized the serious implications of an ill-defined but popular discipline. The search for an EM "Body of Knowledge" was begun. William Peterson of Old Dominion University and Terry Collins of Texas Tech University developed a framework for the EM Body of Knowledge and reported it to ASEM. Don Merino of Stevens Institute of Technology is currently re-defining the work further.

In 2001 ASEM undertook a study to determine the framework that could define the EM discipline at the master's level. Long standing, successful existing programs were reviewed along with industry groups' desires for knowledge and skills of graduates of these programs. The programs examined had many years experience in the discipline and had graduates who had significant achievements in the field.

During the next year, ASEM worked to define the discipline and to develop standards that member schools could use to guide academic program development and content. Once standards (shown in Exhibit 1) were developed, ASEM decided to develop a certification effort to identify those programs that met the standards. The certification process was developed to be similar to an ABET model, including a self-study and a site visit by an assessment team.

The plan for certifying master's programs was presented at the 2002 ASEM National Conference in Tampa, FL. The ASEM Board of Directors studied the plan for one year. In October of 2003, at its National Conference in St. Louis, MO, ASEM authorized a pilot project to use the proposed certification standards on some of the better-known EM programs in the country. That pilot program was completed and the Society is prepared to move ahead and make certification visits to applying programs that have conducted a self-study using the standards. The pilot study and its results are described by Westbrook[3] (2005) in his recent article. The standards are shown in Exhibit 1 and are discussed below.

Certification

The certification process is described in Exhibit 2. Program administrators and faculty perform a self-study in response to how specific standards are met. The self-study is forwarded to ASEM and to the team selected for the site visit. Evaluators are selected from senior ASEM members. The self-study is reviewed prior to the site visit. The certification team clarifies any questions arising from the self-study prior to the visit.

A conscious decision was made early on to view the certification process as a whole. Exceptional circumstances were to be viewed as exceptions not violations. The quality of the program would be assessed on the whole, not the individual parts.

Standards

In developing standards, the programs that had been operating for a long time and were considered to be successful were observed. Areas of program commonality were adapted to form a part of the academic standards. Other standards included faculty standards, student admission, adequate resources, library access, etc. The standards shown in Exhibit 1 were adopted at the ASEM National Conference in October of 2003 and have been in place with only minor modifications since that time. The four standards areas are discussed below. They were created to be both flexible and fair.

A. Faculty Standards

There are three faculty standards.

1. *There must be at least one full time faculty member responsible for the program.* This standard insures that there is at least one full time faculty member associated with the program. Some programs were proposed that were combinations of existing programs with no one person in charge. This standard connects the EM program with the academic processes of the university.

2. *Full time faculty members will teach one-third or more of the program.* This standard further connects the EM programs with the academic processes of the university. Some programs use primarily adjunct faculty members who may not be familiar with latest developments within the discipline.

3. *The faculty workload must be reasonable and appropriate for the stated mission of the program.* This allows the university to match the teaching load with the mission. If it is primarily a teaching program, the work-load would be different from a program that emphasizes research. The standard is intended to ensure that faculty members are not asked to teach large numbers of students and classes and still be held to research and service goals of normal tenure processes.

B. Curriculum Requirements

The standard requires a balance between qualitative and quantitative concepts with the requirement of at least one third of the courses being qualitative management related material. Curricular requirements thus focus on the management side of engineering management. Much of engineering management is conceptually qualitative. Quantitative concepts are required to tie the discipline to the field of engineering. Thus, there is a requirement for both types of concepts. Hick's (1999) study found that qualitative concepts were the most likely to be missing. This standard ensures that the program is, in fact, an engineering management program. The central focus must be on management in some context, at some level.

The remainder of the curriculum standard is typical of the practices of well known EM programs.

C. Admission Requirements

Admission standards are similar to those in most well known EM master's programs. As previously stated, the goal is to set standards to which most established programs already adhere. They are set sufficiently high to ensure an appropriate student population. The experience

requirement is one recommended by employers. They are reluctant to hire or promote an engineer into a management position without significant experience. An experience base was viewed as being as important as the EM education.

Likewise, almost all EM programs admit some outstanding students that have something other than an engineering degree. If these cases are well documented and represent a small minority of the students, it is viewed as sufficient adherence to the standard.

Access to an advisor is included to ensure that students have access to a faculty advisor who can inform the student of degree requirements, course schedules, content, etc. There is concern that some programs may use adjuncts exclusively and not provide this type of academic service adequately.

The requirement for access to the library is similarly motivated. The certification visit includes a visit to the library and a discussion with the appropriate librarian to determine if the EM program in question has planned and adequate library support.

D. Administrative Support

The purpose of this section is to determine if the program has the support from the administration to meet its stated mission. If the program generates significant tuition fees, are these adequately reinvested in the program to provide needed program resources? This also ties into faculty workloads mention in Section A.

Another way of asking this question is, "is the EM program used to generate financial resources for the college without adequate return to sustain the program?" The financial health of the submitted EM program is assessed along with its academic health.

Pilot Program

ASEM made a decision to perform a pilot program to determine if the standards were appropriate. Three programs were submitted for certification visits from long standing EM programs. The teams of visitors selected for the initial visits were composed of senior faculty and administrative officials who had experience teaching in EM programs and were familiar with a range of universities with EM programs.

The initial visits were to Old Dominion University, Stevens Institute of Technology and George Washington University. Stevens requested certification of two programs, the Masters of Engineering in Engineering Management and the Executive Masters in Technology Management.

All three of the visited programs were well known, had active full time faculty with meritorious research and publication records, and were known for the excellent track records of their graduates. Yet, in all cases, the certification teams made significant recommendations based on assessment of the submitted programs based on certification standards. The feedback from department administrators and faculty of the reviewed programs was unanimously positive. Each felt that the self-study they performed and the recommendations of the visiting team provided insight to positive changes for each program. Small adjustments were made in the standards as a result of the pilot program experience. (Administrative Support was enhanced.)

Three options of the MSEM program at the University of Missouri at Rolla were later certified with the modified standards.

Conclusion

ASEM has taken an initial step to define the characteristics of a successful masters program in engineering management. The standards developed are sufficiently flexible to allow the needs of local clients to be taken into consideration. Universities that have certified EM programs found the standards to be both appropriate and challenging. These standards can be used as a framework by institutions in developing new EM masters programs and know that the new program is based on a successful pattern.

In establishing the master's certification program, ASEM is attempting to define the discipline at this level so that universities can design effective EM programs; potential students can select an academic program than meets standards and employers can have confidence in graduates from certified programs.

Exhibit 1. ASEM Certification Standards[4]

Academic Standards

A. Faculty:

1. There will be at least one full time EM faculty member responsible for the program.
2. Full time faculty members will teach one-third or more of the courses. State how many of these are faculty members are designated Engineering Management.
3. The faculty workload must be reasonable and appropriate for the stated mission of the program.

B. Curriculum Requirements

1. A balance between qualitative and quantitative courses
2. At least one third of the curriculum will be management and management related courses.
3. Courses designated "Engineering Management" are in the academic catalog.
4. Course material must be directly related to technology driven organizations.
5. The curriculum must require each student to demonstrate a command of written and oral communication skills in English.
6. Courses must relate to knowledge workers in a global environment.
7. Each student is required to perform a capstone project or thesis using analysis and integration of Engineering Management concepts.
8. A minimum of one course in probability and statistics
9. A minimum of one course in engineering economy
10. Two courses in quantitative analysis courses are required.

C. Students

Admission Requirements

1. Two years of engineering experience in a company based in a developed country
   Or
   Current full time employment in a US company as an engineer
2. For unqualified admission, a 3.0 grade point average from and ABET accredited undergraduate program.
3. Other students may be admitted provisionally with an appropriate mathematical background equivalent to two years of calculus.
4. Administration
   Students must have access to an academic advisor for the purpose of planning a program of study that meets both degree and the student's professional requirements.

5. Support
   The student must have access to appropriate literature. This usually means access to a library with a collection of books and periodicals appropriate to engineering management theory and practices.

D. Administrative Support

The program must have access to sufficient resources and facilities to meet the needs of the targeted student population. Resources generated by the program are sufficiently reinvested in the program.

Exhibit 2. The Certification Process[4]

Certification Process

- ASEM Board of Directors will select EM Certification Evaluators.
- Nominations can be made from the membership.
- All evaluators will be members of ASEM.

The Certification Visit

The Certification Committee of ASEM will select an evaluation team for each program making application to be certificated.
The team makeup will be discussed with the chair of the applying program. Adjustments in committee makeup will be made as necessary.
Two evaluators will be selected to make the visit.
They will use the criteria adopted by ASEM in making the assessment.

Certification Results

- Programs found to be in conformance to the criteria will receive a four-year certification.
- Those programs with minor infractions that may be corrected within a short period of time – one academic year for example will receive a two-year certification. If necessary, a follow-up visit may be required to assess the value of changes made. The follow-up visit will be made by one visitor.
- Submission of evidence of appropriate correction will result in a four - year certification from the date of the initial visit.
- Meritorious programs that do not conform to all Engineering Management certification requirements may be certified as an alternative program.
- Alternative Program Certification is for programs (such as Management of Technology Programs) that have a well-designed curricula, that have a specified and limited mission and that meet most of the EM certification requirements.
- All certified programs will be listed in the EMJ annually.

Certification Costs (Current structure**)**

Fees

Each visit will cost $2,000 initially and will vary in the future with cost of travel. Follow-up visits will be $1,000.The institution seeking certification will cover travel expenses of visitors.

References

1. Farr, John V., and Bowman, Bruce A., "ABET Accreditation of Engineering Management Programs: Contemporary and Future Issues"; Engineering Management Journal, vol. 11, no. 4, December 1999

2. Hicks, Philip C., Utley, Dawn, R and Westbrook, Jerry D.; What Are We Teaching Our Engineering Managers”; Engineering Management Journal, vol. 11 no. 1, March 1999.

3. Westbrook, Jerry D., ASEM’ Effort to Recognize Quality in Engineering Management Master’s Programs, Engineering Management Journal, vol.17, no. 1, March 2005

4. American Society for Engineering Management, “Graduate Program Certification”, http://www.asem.org/members/certific.html