

2006-596: WHERE'S THE MANAGEMENT?

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Introduction

This paper asks the question, “Where’s the management?” much as Clara asked “Where’s the beef?” in the classic Wendy’s commercial. The management content in engineering management graduate programs appears to vary greatly in quantity and does not appear to be found in stand alone management courses, per se, but as components of technical courses where the management content is dependent on the instructor including management topics or putting a management “spin” on the material. Examples of this are the typical project management course and engineering economy course which tend to teach tools and rely on the instructor to place a management context on the “numbers” generated. This paper looks at why the management content is so low and suggests ways to balance the technical and management aspects of EM programs.

Background

Engineering management means different things to different people, so a logical place to start is to give an operational definition to the term. This in turn creates problems, since to a large degree; the definition of engineering management is context sensitive. An engineering manager can be a manager of engineers (the head of an engineering department) or, more generally, an engineer working in a managerial capacity (the plant manager, the operations manager, the material control manager, the accounting manager, the sales manager). Engineering management could thus be the management of engineers (and other similar technical types) or what an engineer does when he/she advances in their career. Similarly, project management can be considered a sub-set of engineering management when engineering skills are required to manage the project (or when an engineer manages the project). Some¹ define engineering management as the skills, knowledge, abilities, and attitude needed to manage and problem-solve in a technology driven organization. Kotnour and Farr² give a description of engineering management field which places engineering management as the bridge between engineering and management. For this paper we are defining engineering management broadly and thus as the skills needed by an engineer to effectively manage processes and people.

Engineering management programs also mean different things to different people. There is no commonly recognized body of knowledge for engineering management³ and the requirements for ABET⁴ accreditation of engineering management programs are very general. Most graduate level engineering programs are not ABET accredited for a variety of reasons which has raised quality issues on occasions. The American Society for Engineering Management (ASEM) has addressed this perceived quality issue with its certification program as reported by Westbrook⁵. Graduate programs tend to fall into three categories as reported by Hicks, Utley, and Westbrook⁶ and focus on either: (1) classical concepts of management, (2) mathematical concepts, or (3) behavioral management. In developing its standards for certification, ASEM made two significant (to this paper) curriculum requirements⁷: (1) a balance between qualitative and quantitative courses and (2) a requirement that at least one third of the coursework be management and management-related. Thus, whether the student desires to acquire a master’s

degree to better qualify for or perform better in a managerial position or is looking to acquire skills to function as a better engineer in a technology driven firm, the academic program should provide engineering management skills - the skills needed by an engineer to effectively manage processes and people.

Reporting to the ASEM Board of Directors, in his role as Dean of the College of Engineering Management Certification, Dr. Jerry Westbrook has repeatedly included comments on the narrow margin by which several of the certified graduate EM programs have met the requirement for one third of the curriculum to be management and management-related course. This often required the counting of portions of several courses in meeting this requirement. This, in our opinion, clearly reflects the low level of management content in our curricula.

Does a Problem Exist?

Is there a problem in the managerial content of EM graduate programs? This is not a simple question but one of many parts. First we will make some assumptions based on the students and their goals and desires:

- The students in the program are engineers. We know this is a weak assumption since many programs accept graduates of engineering technology programs, quantitative-based science programs (chemistry as an example), and some programs are even more flexible in their admittance policy.
- The students are pursuing a degree to advance their careers. We are comfortable with this assumption but would differentiate between those students who see the degree as a way to improve skills and those “checking off a box” on the career progression requirement.

Having made these assumptions, the question becomes one does the student seek to acquire managerial skills or technology skills. Either way, the student needs managerial skills to be effective as an engineer especially as their role in the organization expands with seniority. The question may be one of whether the student understands the importance of “people” skills since the assumption is that the student comes from an “engineering” background with all that implies. Engineers are historically perceived in the workplace as needing polish in their people skills. We firmly believe that graduates of engineering management programs should have a managerial skill set appropriate to a senior management position in engineering (director of engineering for a large division of a corporation or vice president of engineering for a small (500 employee) company) at a minimum.

A second part of the question of the managerial content of EM graduate programs relates to the faculty offering the program. In this instance we use the term faculty to represent both the people and the organization to which these people belong. Faculty members at most, if not all, universities are under pressure to do funded research and to publish the results of said research. As engineering faculty, they come from a predominately quantitative tradition and the traditional publication outlets for their peers are predominately quantitative. An example would be industrial engineering faculty with *IIE Transactions* being an “A” publication and *IIE Transactions* seeks to publish quantitative articles⁸. Since management research tends to be best done in the places where it is practiced and since this research is largely qualitative and involves a small number of repetitions (cases, projects, observations – unless survey based), the results are often difficult to publish due to confidentiality on the data, the desire of the sponsor of the

research to not open its inner workings to public scrutiny, and the preference of most engineering publications for quantitative research. Since faculty seldom publish on management topics, few graduate students (and future faculty members) pursue management topics for research. Thus when they in turn join the faculty they are not comfortable with management topics from either a practical or theoretical standpoint. This can be especially true when a portion of any typical EM graduate class is working managers (and as discussed earlier most engineers early in their careers are managing projects and teams) who may very well versed in the practical side of the “trials and tribulations” of engineering management and as such make a very tough audience for those without an appreciation of the practitioner’s point of view. An additional complication is in the nature of management – there are often many correct answers and the correctness can be situational, the personality of the manager, and highly dependent on those being managed. This requires the faculty member to be flexible, articulate, comfortable with the topic, and ready to engage the class in a dialog. Quantitative courses are much easier to teach – they are number driven and have single correct answer – and both the students and the faculty are more comfortable with this type material. Since it is common for the admittance requirements for EM programs to require five years of post-bachelor’s degree practice for admittance, it should be anticipated that the students in the program have had exposure to engineering management in practice and have worked in a managerial role at least as a project manager. This makes a compelling argument for a reasonable expectation on the students’ part that the faculty teaching the course has had practical experience as an engineering manager in addition to academic qualifications. If this is a reasonable expectation, then if the faculty do not have this qualification, it is not unreasonable for them to avoid this type course.

A final problem of many programs is the “ownership” of management courses by the business school and the associated problems of getting courses through curriculum committees. The basic organizational behavior courses in the business school can provide a good foundation for engineering management but they are not enough. As seen in undergraduate programs with math, it is not enough to teach the students math. They must be taught to apply it solve engineering problems to make it relevant. We would argue the same is true for management at the graduate engineering level. We are not advocating to duplicate these course for engineers but to structure management courses to fit the need of the students. This requires that the faculty be knowledgeable about management and to be experts in management in addition to experts in engineering.

Conclusions and Recommendations

Based on the above, we have reached several conclusions.

1. A written EM body of knowledge which the academic EM programs can buy into needs to be pursued.
2. The ASEM Certification program needs to be evaluated and embraced by the academic programs - subject to continuous improvement of the program.
3. EM programs must emphasis management of people and processes on an equal footing in the content of the programs.

4. The management aspects of engineering need to be a portion of every engineering management course – “once we get the number, what does it mean and what do we do with it” should be central to every course. No course in engineering management can stop once the number is found.
5. Faculties in engineering management programs need to include a solid leavening of people who either (a) have an EM degree (and thus meet the expectations for admittance to typical EM graduate programs of practical engineering experience) or (b) have had practical management experience outside academia. While it is unreasonable to expect this degree and practical management experience of all of the faculty members in an EM program, a significant portion of the faculty should meet this expectation. Just as we have found that ethnic and gender diversity of the faculty tends to encourage a similar diversity in the students who come into a program, we believe diversity in the degrees and experience of the faculty has value also.

At the start of this paper we outlined a question (where’s the management?). Based on our subjective review we believe that there is a need for research into this question (the need for management content in EM programs). Our next step is to develop a pilot study to see if in deed the question we have is relevant. If it is, we plan to proceed to try and answer our underlying questions:

1. How much management do engineering management students need?
2. How do we best teach management to engineering management students?

These are not simple questions. We fully expect them to be complex and largely related to the expectations of the students and the objectives of the specific programs.

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