An Analysis of the Career Value of a Graduate Engineering Management Degree Revisited

William J. Daughton
Lockheed Martin Engineering Management Program
University of Colorado at Boulder

Abstract

The Lockheed Martin Engineering Management Program in the College of Engineering and Applied Science at the University of Colorado at Boulder has been granting graduate degrees for 16 years, and in that time well over 200 engineers have graduated. The focus of the graduate program is to prepare individuals who have been working as professional engineers for two to approximately six years for technical management career paths. We have been interested in the value of this degree to the career advancement of our graduates. A preceding paper analyzed the overall value of the degree to our students, and in this paper the career value of individual course subjects is analyzed. The data from faculty course questionnaires (FCQ) provided by students for the last three years has been used to evaluate the career value of these courses and is presented here.

Background

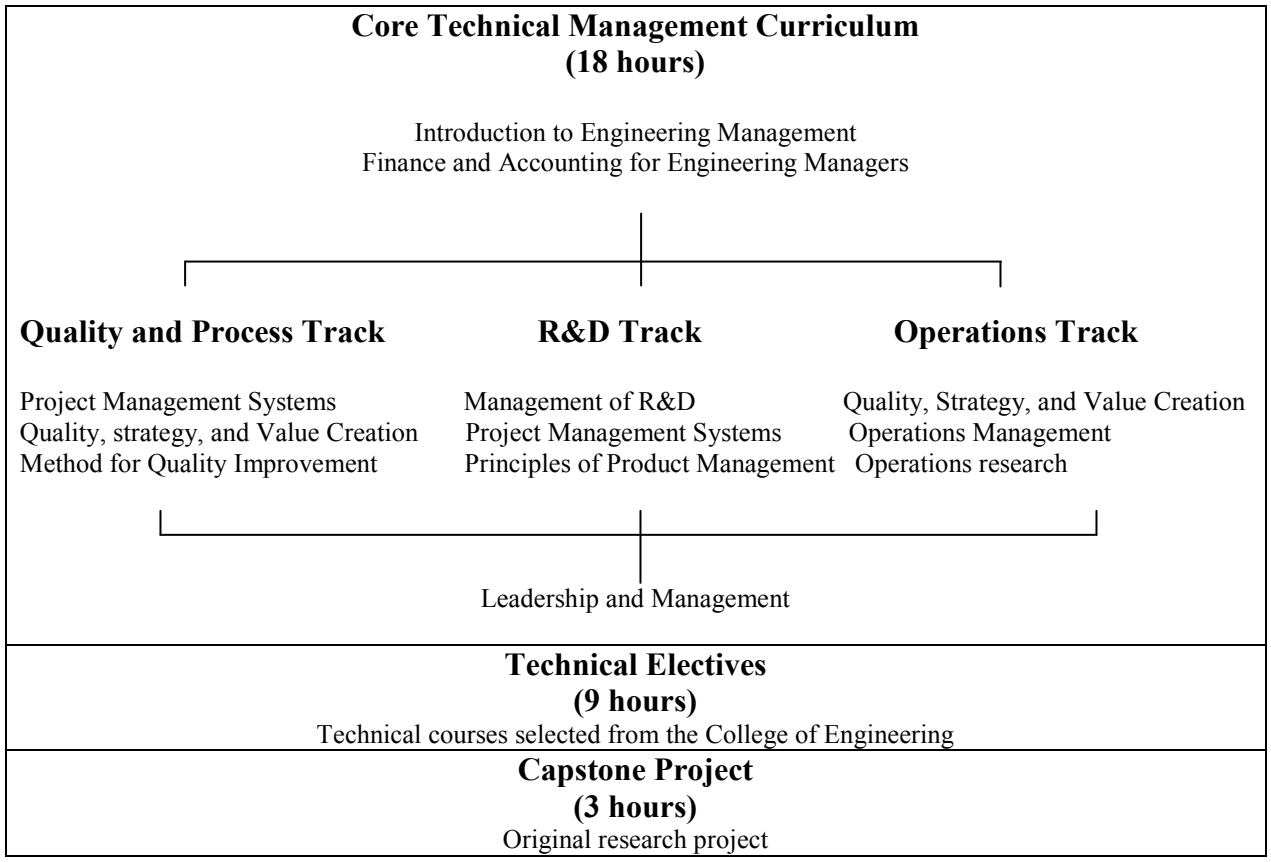
The program evolved from discussion between the College of Engineering and Applied Science and local industry about the need to provide engineers with a practical set of management skills prior to undertaking early management assignments. Local high technology companies were concerned that many engineers were entering management positions responsible for project or development teams or promoted to managers of small departments or work groups with little preparation. Ironically, these opportunities sometimes came as a reward for a job well done for engineering contributions but placed the individual in an awkward position. As Matson[1] and Lancaster[2] have reported, and this author observed while working in industry, engineers usually find themselves very poorly equipped to take on their management assignments.

As the program evolved over the next 16 years, the enrollment grew to include students from Colorado, from across the United States, and from around the world. As pointed out in a previous paper[3], the students are very interested in the value of this graduate education to not only an initial promotion into a management position but also to their long-term career opportunities. Since the previous paper focused on the career value of the Engineering Management degree itself, the focus of this paper is on career value of individual course subjects in the curriculum. The approach was to utilize the formal course evaluation forms competed by students at the end of each course to develop the data for this study.

Curriculum

The program curriculum through 2003 with individual course titles is illustrated in Table 1. The curriculum is divided into three focused tracks. These tracks are in quality and process management, R&D management, and operations management. Students are required to select one of the three core curriculum track options when they begin their course of study. Three technical electives and a final capstone research project are also required to complete the degree

Table 1. Program Curriculum



A brief description of the 10 courses listed above in the core curriculum is shown in Table 2 along with the corresponding course numbers for reference. The descriptions are relevant to understanding and appreciating the ratings of these courses presented later. The first two courses, EMEN 5010 and EMEN 5020, and the last course, EMEN 5050, in the core curriculum are common to all tracks. In constructing this track approach, the faculty believed that these courses were fundamental to a successful management career. The courses in each specific track are more focused on the track areas of emphasis, and many of these courses are definitely focused on specific management skill requirements.

Table 2. Core Curriculum Course Descriptions

Course Title	Description
EMEN 5010 Introduction to Engineering Management	Provides an overview of the concepts and philosophy of technical management. Includes leadership, knowledge management, strategic planning, human resources, process management, total quality, and customer satisfaction.
EMEN 5020 Finance and Accounting for Engineering Managers	Provides the concepts and skills necessary to financially analyze projects and assess financial performance of an organization. Includes time value of money, comparison of alternatives, taxes, risk management, cash flow, and financial statements
EMEN 5030 Project Management Systems	Presents the basic skills required to manage a wide range of technical projects. Topics include selecting project alternatives, managing project teams, developing project plan elements, risk management, monitoring and controlling projects, and financial analysis. Students apply skills learned to a representative project.
EMEN 5040 Quality, Strategy, and Value Creation	Establishes the foundations to understand the urgency for quality improvement and excellence goals as an executive priority based on the teachings of W. Edwards Deming. Covers the systems approach, theory of variation, theory of knowledge, and psychology relating to these goals. Provides links to continuing discovery within the learning organization, and the value creating the underpinnings of intellectual capital.
EMEN 5042 Methods for Quality Improvement	Addresses today's global economic environment in that product, service, and process improvement are the platforms for innovation and value creation. Examines methods for linking customer needs and wants to products and services as well as process development, control, and improvement. Methods covered include quality function deployment, statistical process control, and design of experiments.
EMEN 5050 Leadership and Management	Provides working engineers a background in leadership and management theory and enables them to develop practical skills in leading and managing. Topics include managerial styles, organizational factors, communications, ethics, change management, and conflict resolution.
EMEN 5300 Management of R&D	Explores how research and development contribute to technological innovation and they are conducted and managed in American universities, government laboratories, and industry. Topics include research and development strategies, innovation and creativity concepts, the R&D process, and the management of R&D organizations and personnel.
EMEN 5400 Principles of Product	Explores the methodology for the management of new products from idea inception to product discontinuation.

Management	Emphasizes product development and market analysis in traditional and entrepreneurial settings. Students apply lessons to a product introduction project.
EMEN 5500 Operations Management	Provides models, methods, and case studies illustrating the management of modern manufacturing operations. Topics include systems and process management, facilities management, equipment management, materials management, and labor management.
EMEN 5600 Operations Research	Applications oriented survey of operations research topics including linear and integer programming, network analysis, dynamic programming, non-linear programming, decision analysis, Markov chain and Markovian decision models, queing theory, and simulation.

Course Evaluation

At the end of the delivery of each course in the core curriculum, students are given the option of filling out a course evaluation referred to as a Faculty Course Questionnaire (FCQ). This course evaluation system is administered by the Boulder campus[4], and the results are provided to the course instructor and the departments. Optional questions can be selected by departments for their courses, and one related to the career value of the specific course is routinely used by Engineering Management in its questionnaires. The particular question utilized for this purpose is:

FCQ Optional Question 416: "The course's relevance to my career objectives was"[5]

The question is evaluated on a 5-point scale ranging from "A" to "F" with "A" in this case representing a very high relevance, and "F" essentially representing no relevance.
Results for this question have been gathered over the last three years for each of the core curriculum courses from FCQs of program students. The courses are offered once each year, so the data represent responses from the last three offerings of each course. It should be noted that the surveys are paper-based and mailed to the population of students, the vast majority of which are remote. Participation is anonymous and voluntary. Despite this, the response rate for all courses over this period exceeds 50%. The total percentage responses in each rating category for each course are shown in Table 3.

Table 3. FCQ Results for Optional Question 416

Course	Total Respondents	Rating A	B	C	D	F
EMEN 5010	50	74%	20%	6%	0%	0%
EMEN 5020	57	56%	33%	11%	0%	0%
EMEN 5030	29	72%	21%	7%	0%	0%
EMEN 5040	39	62%	31%	7%	0%	0%

EMEN 5042	N/A*					
EMEN 5050	9*	78%	22%	0%	0%	0%
EMEN 5300	21	67%	14%	14%	5%	0%
EMEN 5400	27	63%	33%	4%	0%	0%
EMEN 5500	14	57%	22%	21%	0%	0%
EMEN 5600	31	45%	42%	13%	0%	0%

*Summer Courses in which FCQ system is not regularly utilized

Analysis

Based on the "A" ratings, i.e. very relevant to the respondent's career, the course on general management principles and concepts, EMEN 5010, and the course on leadership, EMEN 5050, stand out above the rest as ones that our students see as valuable to fulfilling their career objectives. Closely behind is project management, EMEN 5030, which has gained a reputation as a career "must" for everyone. The first two are clearly contain topics necessary to overall management career success so the high scores are consistent with the thinking of the faculty on the purpose of these courses. Overall, all the courses were considered to have positive career value. However, the lower "A ratings" are likely representative of the consideration of these courses as more focused on specific job skills. This would seem to apply to the very practical operations courses, EMEN 5500 and EMEN 5600. Although there are no FCA ratings for EMEN 5042, by it very nature it would likely be considered more of a tools or skills course as well. Of some surprise is the response to the finance and accounting course, EMEN 5020. This course is taught at a higher level than a basic course in engineering economics. Much emphasis is placed on intellectual capital in this course, so the faculty here would perceive this as more of a career-related course rather than a short-term economic tools course. The "A" rating results, however, do not support that compared to other courses perceived to be at that level.

Conclusion

The clear message from responses to the first survey described in a preceding paper[3] is that additional management skills were quite important to a large number of our students for new jobs or promotions. The results also indicated that the engineering management degree was a significant contributor in achieving the career objectives of personal job satisfaction and in creating more job opportunities. That paper raised the common problem encountered in a professional program such as this one where on the one hand there is a need to create perspective and provide insight on the role and function of technical managers in a complex organizational environment, while on the other hand these new managers need skills in specific areas. The results from this paper seem to indicate that the students appreciate the difference between these two areas of focus. The " very valuable" responses to the career value of EMEN 5010, EMEN 5050, and EMEN 5030 support our thinking that these courses are really preparing our students for long-term success in management while others in the curriculum provide more of a skills value. The fact that all the courses have positive career value results collectively reinforce the results from the earlier paper that our students recognize the value the professional degree in Engineering Management provides to achieving career objectives.

Bibliography

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WILLIAM J. DAUGHTON
Through December of 2003, William J. Daughton was the Lockheed Martin Professor and Director of the Lockheed Martin Engineering Management Program at the University of Colorado. Beginning in January of 2004 he is Professor and Department Chairman of the Engineering Management Department at the University of Missouri - Rolla . Dr. Daughton has extensive management experience in high technology industry as well as significant college level teaching experience in physics, engineering, and management. Dr. Daughton has a B.A. in Physics and Mathematics from Illinois College, a M.S. in Physics from South Dakota School of Mines and Technology, and a Ph.D. in Solid-state Physics from the University of Missouri.