2006-588: GROWTH OF A YOUNG ENGINEERING MANAGEMENT PROGRAM

Yesim Sireli, University of North Carolina-Charlotte

Yesim Sireli is an Assistant Professor at the Engineering Management Program at the University of North Carolina at Charlotte. She received a Ph.D. degree in Engineering Management from Old Dominion University, and also holds MSc and BSc degrees in Electrical Engineering. Her research interests include business forecasting, decision analysis, customer-oriented product development, quality management, and technology management.

S. Gary Teng, University of North Carolina-Charlotte

S. Gary Teng is the Director of Engineering Management Program and Center for Lean Logistics and Engineered Systems at the University of North Carolina at Charlotte. He holds B.E., M.S., and Ph.D. degrees in Industrial Engineering. Dr. Teng holds a Professional Engineer license in the State of Wisconsin and is certified by American Society for Quality as a Certified Quality Engineer and Reliability Engineer. His research interests are in engineering system design and analysis, lean systems design and implementation, logistics systems and supply chain management, and quality and reliability engineering.

Ertunga Ozelkan, University of North Carolina-Charlotte

Ertunga Ozelkan is an Assistant Professor at the Engineering Management Program and the Associate Director of the Center for Lean Logistics and Engineered Systems at the University of North Carolina at Charlotte. He received a Ph.D. degree in Systems and Industrial Engineering from the University of Arizona. His current research interests include supply chain management, decision analysis, and optimization.

© American Society for Engineering Education, 2006

Growth of a Young Engineering Management Program

Abstract

The Engineering Management Program of the University of North Carolina at Charlotte (UNCC) is a master's level program founded in Fall 2000, offering courses together with the College of Business Administration and focusing on establishing close ties with the industry. Over the past few years, it increased the number of its faculty as well as the variety of courses in its curriculum. Recently, UNCC decided to transform this program into a new Systems Engineering and Engineering Management Department. This transition requires the development of a roadmap for the Engineering Management Program to follow towards becoming a department. Consequently, the goal of this study is to identify the objectives of the new department and determine the activities that should take place to realize those objectives. This study uses a Quality Function Deployment (QFD) analysis to achieve its goal.

I. Introduction

The University of North Carolina at Charlotte's Engineering Management Master's Program was founded in Fall 2000 following the industry demand in the fast growing Charlotte area, as Teng and Shelnutt stated in their paper[1]. The program's objective was to serve the industry's needs around the campus and its first student body included mostly full-time career individuals. Over the past few years, the program grew, served full-time as well as part-time students, and added new members to its faculty as well as a new variety of courses to its curriculum. Recently, UNCC decided to transform this program into a Systems Engineering and Engineering Management Department, starting with a Bachelor's degree in Systems Engineering. The program faculty are in the process of identifying the objectives that are important for establishing a new department and the activities to achieve those objectives. Similar to the goals of the program, the department is expected to serve the industry. Offering a competitive and distinguished curriculum, developing an impressive research portfolio, providing students with an effective learning environment are believed to be important objectives of the new department. Student recruitment and retention, faculty recruitment and retention, and domestic and international recognition of the department are also natural objectives that a new department should consider.

The purpose of this study is to determine the necessary activities to meet the requirements of a well-founded Systems Engineering and Engineering Management Department. A QFD analysis is used to identify the most important activities.

II. QFD Application

The QFD application starts with the selection of requirements and candidate activities to meet those requirements. Then, the importance levels of the requirements are determined. After that, the relationship matrix is completed, which ties the activities to the requirements. And finally, the absolute and relative importance values of all activities are calculated and consequently the most important activity list is achieved. All these actions are conducted based on a consensus reached by the current faculty of the Engineering Management Program. This section discusses

the QFD implementation beginning with the definitions and lists of the requirements and activities.

2.1 Requirements and Activities

Requirements (or objectives) are defined as selected factors that are important for healthy establishment of the Systems Engineering & Engineering Management Department as follows.

- Student recruitment
- Student retention
- Competitive curriculum
- Effective learning environment
- Faculty recruitment
- Faculty retention
- Research portfolio development
- Domestic recognition of the department
- International recognition of the department
- Establishing and maintaining close relations with the industry

Activities, on the other hand, are defined as planned and unplanned actions to meet the requirements of the future department. They consist of the following sub-categories:

1. Activities related to student recruitment/retention and teaching
2. Activities related to faculty recruitment/retention and research
3. Activities related to the recognition of the department
4. Activities related to establishing and maintaining close relations with the industry

Our QFD approach utilizes only one QFD matrix instead of implementing separate matrices for each sub-category listed above, because some activities belong to more than one category. Therefore, 25 potentially significant activities were chosen, which relate to all four sub-categories. A letter is assigned to each activity for ease of use in the QFD matrix (Table 1).

- A: Availability of Research/Teaching Assistant (RA/TA) funding
- B: Application-oriented class content
- C: Up-to-date and real issues discussed in class
- D: Providing opportunities for students to involve in actual industrial practice
- E: Teaching systems thinking in class (business / management focus as well as engineering)
- F: Cooperative learning and teamwork in class
- G: Project-based learning
- H: Mailing EMGT posters to domestic and international academic institutions
- I: Funding for domestic and international conference/seminar/meeting attendance for the faculty
- J: Faculty's efforts to produce journal articles
- K: Reduced teaching-load for the first year of new faculty
- L: Reduced teaching -load for research (release time for faculty)

- M: Forum to collaborate with other faculty/departments
- N: Mentoring new faculty
- O: Start-up funding for new faculty
- P: Administrative support for faculty
- Q: Computational infrastructure for research
- R: Quality of the teaching environment (classroom and online infrastructure)
- S: Establishment of a research center
- T: Establishment of a certificate program
- U: Working collaboratively with marketing-related divisions of the university
- V: Providing consultancy to professional organizations
- W: Mailing EMGT posters to companies
- X: Courses designed according to specific demands of the industry
- Y: Routine meetings with industry representatives

2.2 QFD Matrix

The QFD matrix incorporates all selected requirements, activities and their relationship scores. The importance levels of the requirements are expected to be somewhat close to each other, even though a moderate distinction between them is necessary. Therefore, a 1-3-5 scale is used as specified below.

1: Requirement is somewhat important
3: Requirement is important
5: Requirement is very important

To fill out the relationship matrix, a 0-1-3-9 scale is utilized for the matrix to be dominated by strong impacts, so that the most important activities can be distinguished more visibly. This scale is identified below.

0: Activity has no impact on realization of requirement
1: Activity has weak impact on realization of requirement
3: Activity has moderate impact on realization of requirement
9: Activity has strong impact on realization of requirement

The faculty of the Engineering Management Program has completed the QFD matrix based on their opinions about the importance of each requirement and the impact of each activity on requirements as shown in Table 1.

Table 1. QFD matrix.

		Activities**																								
Requirements	**RI***	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**
Student recruitment	5	9	3	3	3	1	0	1	3	0	0	0	0	0	0	0	0	0	1	0	3	3	1	3	9	1
Student retention	5	9	3	3	3	9	3	3	0	0	0	0	0	0	0	0	0	0	9	1	0	0	0	0	9	0
Competitive curriculum	5	0	9	9	9	9	3	3	0	0	0	0	0	0	1	0	1	1	3	1	3	0	0	0	9	1
Effective learning environment	3	3	9	9	9	3	9	9	0	1	1	3	0	1	1	0	0	1	9	1	1	0	0	0	3	0
Faculty recruitment	5	9	1	1	0	1	0	1	0	9	3	9	9	9	9	9	1	3	1	1	0	0	0	0	0	0
Faculty retention	5	3	1	1	0	1	0	1	0	3	9	0	9	9	3	1	3	9	3	3	0	0	1	0	0	0
Research portfolio development	5	9	1	1	3	0	0	1	0	3	9	9	9	9	1	3	1	9	0	9	0	1	1	0	1	3
Domestic recognition of the dept.	3	3	1	1	1	1	1	0	9	9	3	0	0	1	0	0	3	0	1	1	9	9	1	9	1	1
International recognition of the dept.	3	9	1	1	1	1	1	0	9	9	3	0	0	0	0	0	3	0	1	1	9	9	1	1	0	0
Close relations with the industry	5	0	3	3	3	3	0	1	0	0	0	0	3	0	0	0	1	0	0	9	9	0	9	9	9	9
Absolute importance of DRs:		240	138	138	138	135	63	82	69	132	126	99	150	141	73	65	53	113	118	129	132	74	66	90	197	73
Relative importance of DRs:		**8.5%**	**4.9%**	**4.9%**	**4.9%**	**4.8%**	**2.2%**	**2.9%**	**2.4%**	**4.7%**	**4.4%**	**3.5%**	**5.3%**	**5.0%**	**2.6%**	**2.3%**	**1.9%**	**4.0%**	**4.2%**	**4.6%**	**4.7%**	**2.6%**	**2.3%**	**3.2%**	**7.0%**	**2.6%**

*RI: Requirement Importance values. **Activities: See activities list in Section 2.1 for the descriptions of the letters.

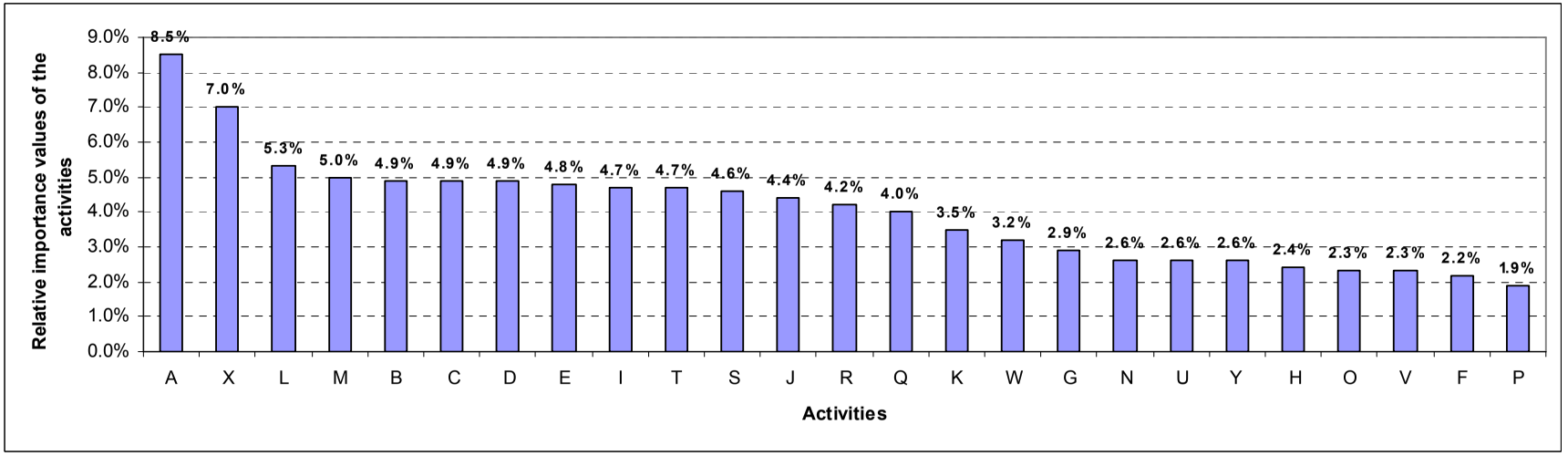

Figure 1. Relative importance values of the activities (in descending order).

Based on the results of the QFD analysis, the activities can be grouped in three sections according to their relative importance values. Figure 1 illustrates the relative importance values of all activities in descending order. If these values are divided into three groups, the first group contains the highest one-third of all activities. These are the most important activities to work on when establishing the new department. The second one-third contains the activities that are important compared to the rest, and the last one-third covers less important activities as summarized in Table 2.

According to this analysis, the availability of RA/TA funding has the strongest impact on meeting high-priority requirements such as student recruitment and retention, faculty recruitment, and research portfolio development. RA/TA funding becomes especially important for recruiting international students. Designing courses according to the demands of the industry is the second most important activity that the new department should work on. It is considered particularly essential for student recruitment and retention, competitive curriculum development and keeping close relations with the industry.

The second group includes important activities such as reduced teaching-load for research (release time for faculty), opportunities offered to faculty to collaborate with other faculty/departments, application oriented class content and up-to-date discussions for students, opportunities provided to students to involve in actual industrial practice, and so on.

The last group contains activities that have the lowest impact on the realization of the requirements. Start-up funding for new faculty, consultancy offered to professional organizations, cooperative learning and teamwork in class, and administrative support for faculty are among the activities with the lowest importance values.

Table 2. Activities categorized in three groups.

The most important activities in descending order (8.5% - 6.3%)	Important activities in descending order (6.3% - 4.1%)	Less important activities in descending order (4.1% - 1.9%)
▪ Availability of RA/TA funding (A: 8.5%) ▪ Courses designed according to specific demands of the industry (X: 7%)	▪ Reduced teaching -load for research (release time for faculty) (L: 5.3%) ▪ Forum to collaborate with other faculty/departments (M: 5%) ▪ Application-oriented class content, Up-to-date and real issues discussed in class, and Providing opportunities for students to involve in actual industrial practice (B, C and D respectively: 4.9%) ▪ Teaching systems thinking in class (business / management focus as well as engineering) (E: 4.8%) ▪ Funding for domestic and international conference/seminar/meeting attendance for the faculty, and Establishment of a certificate program (I and T respectively: 4.7%) ▪ Establishment of a research center (S: 4.6%) ▪ Faculty's efforts to produce journal articles (J: 4.4%) ▪ Quality of the teaching environment (classroom and online infrastructure) (R: 4.2%)	▪ Computational infrastructure for research (Q: 4.0%) ▪ Reduced teaching-load for the first year of new faculty (K: 3.5%) ▪ Mailing EMGT posters to companies (W: 3.2%) ▪ Project-based learning (G: 2.9%) ▪ Mentoring new faculty, Working collaboratively with marketing-related divisions of the university, and Routine meetings with industry representatives (N, U and Y respectively): 2.6%) ▪ Mailing EMGT posters to domestic and international academic institutions (H: 2.4%) ▪ Start-up funding for new faculty and Providing consultancy to professional organizations (O and V respectively: 2.3%) ▪ Cooperative learning and teamwork in class (F: 2.2%) ▪ Administrative support for faculty (P: 1.9%)

III. Activities Underway

Some of the activities labeled as "important" according to the QFD results are already underway at the Engineering Management Program and are expected to continue when the department is established. Application-oriented class content, up-to-date and real issues discussed in class, and providing opportunities for students to involve in actual industrial practice are among these. As an example, during Fall of 2005, a lean business simulation project was conducted in collaboration with American Society for Quality (ASQ). The program also focuses on teaching systems thinking to their students to train them to see the big picture in an organizational environment. This is especially important for students with pure engineering backgrounds since it arms the students with business and management skills as well, which is very important for a systems engineer or an engineering manager[2].

Another activity among the important ones is the establishment of a research center called Center for Lean Logistics & Engineered Systems (CLLES) with the objective of integrating industry's needs into faculty research activities. CLLES is offering a Supply Chain Management Certificate Program beginning Spring 2006.

IV. Conclusions

UNCC's Engineering Management Program is working towards becoming the Systems Engineering and Engineering Management Department. By means of a QFD analysis, this study listed necessary requirements for establishing the department, and groups of activities needed to meet those requirements. Most of the activities labeled as "important" are already underway in this program and based on the QFD results, the department must continue working on and improving these activities. However, in order to realize its objectives, the department must particularly focus on making RA/TA funding available to worthy students and designing courses according to the specific demands of the industry since these are the most important activities among all identified.

Future work should include gathering information about the establishment process of previously founded departments in the Engineering College. It would be useful, for the Systems Engineering and Engineering Management Program as well as other future programs, to compare the initial road map developed in this study with the experiences of those existing programs, including lessons learned and best practices.

Bibliographic Information

1. S. Gary Teng and J. William Shelnutt, "The Development of an MSEM Program with a Close Tie to Industry," *the 2002 ASEE Annual Conference & Exposition,* Montréal, Quebec, Canada, June 16-19, 2002.
2. Dan Babcock, and Lucy Morse, *Managing Engineering and Technology, 3rd Edition,* Prentice Hall, 2002.