A New Online Master of Engineering in Technical Management

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An Industry-Focused New Online Master of Engineering Technical Management

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Abstract

With the challenges facing us on a global level, there is a new need for technology driven companies to develop their professional and managerial workforce to integrate technical and business skills to solve these difficult problems. Currently, most graduate programs focus on technical skills or business acumen, but not both. The proposed Master of Engineering Technical Management (METM) can fill this gap. METM program is meeting the demand for such professionals and are distinctive among engineering programs in their integration of business, management, engineering and leadership.

The Master of Engineering Technical Management is a distance-learning professional graduate program for early to mid-career technical professionals. This rigorous program is industry-oriented, and relevant to electronics, manufacturing, automation, energy, process and related industrial channels. The program targets engineering and technical professionals and allows them to become future leaders in technical management positions, while continuing to work in their companies. The program's curriculum, carefully crafted in consultation with industrial leaders, provides a unique blend of industry-critical skills in managing people, projects and profitability. The curriculum will be taught by three groups of professionals: professors, professor-experts, and the industry experts. The curriculum is 20%, 60% and 20%, analytical, technical management and capstone project, respectively. The graduates of this program will meet industry needs for qualified technical managers and leaders resulting from the expected industrial growth in the short- and medium-term future.

Introduction

An explosion of technological advances is continually transforming the way we live and do business. Engineering managers have incredible opportunities to guide the development of technology in the production of goods and services that fulfill commercial and social needs. To be as effective as possible, they must possess both the engineering expertise to understand the technology they are managing, and the managerial skills to facilitate the efficient development and implementation of that technology. Their effectiveness is further enhanced when they can integrate these two competencies by bringing "a management perspective to the engineering problem and an engineering perspective to a management decision". The METM program is offered by the Engineering Technology and Industrial Distribution department within the College of Engineering at Texas A&M University starting in fall 2018 will focus developing the above two competencies.

The program differs from a traditional Master of Science degree in engineering by concentrating on current industry best practice rather than on research, and differs from a traditional Master of

Business Administration (MBA) degree by emphasizing the technical and engineering context of business topics.

Students will have plenty of practice discussing real world management cases and interacting with their experienced instructors and student peers. Upon completing the METM degree program, students/organizations will benefit by:

- Demonstrating the ability to develop a technical program plan for an engineering project.
- Developing the ability to lead and manage a diverse team of technical professionals utilizing emotional intelligence.
- Developing interpersonal and collaboration skills to help effectively communicate with non-technical colleagues and customers.
- Creating a learning environment which addresses critical competencies needed to enhance technical skills, business acumen and personal effectiveness in the workplace.
- Developing a systematic and analytic framework to support decision making and make effective changes.

Program

The needs assessment for the proposed Master of Engineering in Technical Management (METM) program was determined using: (1) Meeting with Industry Focus-Group, (2) Survey potential students and industry sponsors, (3) and feedback from current programs' Industry Advisory Boards, (4) database research on potential job markets, and (5) Industry Letters of Support.

The objective of the meeting with an industry focus-group was to determine the skills required for future technical managers and identify the skill-gaps in the current workforce; this information served as the basis to design the program-level learning objectives (PLO) and curriculum of the proposed METM program. In addition, a large survey was conducted presenting the proposed curriculum to the potential students and potential sponsors with the objectives of validating the curriculum and PLO's. Furthermore, job market research was conducted to verify that the job market targeted had growth prospects. Details of these three needs assessment studies are described in the next two subsections. Finally, we received letters from industry that strongly support the creating of the proposed Master of Engineering in Technical Management.

Needs Assessment with Industry Focus Group: To gather direct requirements from industry, the Engineering Technology and Industrial Distribution (ETID) department consulted with leaders of key industries in Texas, including energy, equipment manufacturers, electronics, and automation, to define the specific characteristics of a program that would satisfy their current and future workforce needs. The needs assessment workshop was held on the Texas A&M University campus on February 4, 2015. The meeting was hosted by the ETID department and facilitated by Center for Teaching Excellence.

Companies representing strategic industry sectors in Texas were Baker Hughes, MIC Group, Applied Materials, National Instruments, BP International, Honeywell Process, Solutions, and Oil States Industries, Inc. The company representatives that attended were selected based on their

commitment to engineering education, and potential to fund employees to participate in the new graduate program.

Specific results of the focus group meeting were used to define the characteristics and curriculum of the proposed program by establishing the skill-set required for graduates of the proposed program, and identifying the particular gaps observed in graduates from similar programs. The information gathered in the meeting was analyzed and synthesized as Program Level Learning Outcomes (PLO). Briefly, the PLOs are summarized as:

1. Manage new product development
2. Demonstrate project management skills
3. Manage resources and assets
4. Practice leadership
5. Communicate clearly and effectively to both technical and non-technical audiences
6. Demonstrate financial and business acumen
7. Negotiate and manage contracts
8. Assure continuous improvement of quality in products and processes
9. Apply data driven approach to decision making
10. Apply problem solving and critical thinking methods

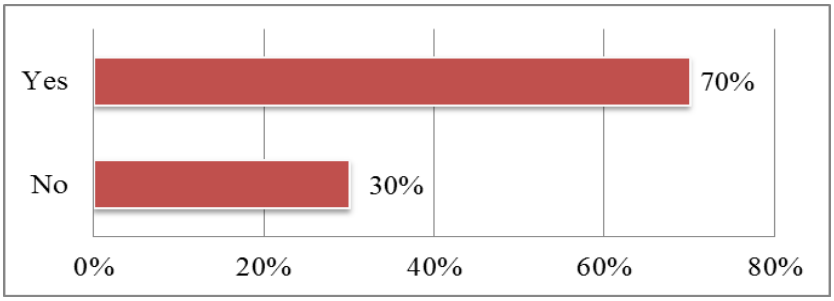
Letters of Support from Industry. We received strong letters of support from industry. Letters confirm the need and market for a program like the one proposed.

Student Demand – Two research methods were used in order to establish the potential student demand. The first and main methodology was a large scale survey aimed at potential students and industry leaders that could potentially sponsor students in the program; the second methodology was database research to validate the employment growth in the engineering areas targeted by the proposed program.

a. Survey of Potential Students and Industry Sponsors - A survey was deployed to validate the specific PLOs defined for the proposed program, and to gage the student demand for a program using the specific learning outcomes for the proposed program. The results show a significant potential demand for the proposed program; briefly:

- Survey was sent to:
  - ETID Former Student List – 3119
  - ETD-Listserv ~ Few Thousand
  - Third Party Industry List Rental – 7000
- Survey Response:
  - About 240 Responses
  - Respondents' work experience: 80% had more than 6 years of experience, 12% had between 3 to 5 years of experience, and 8% had 2 or less years of experience.
- The PLO's were validated as important skills where the current workforce lacks proficiency in (i.e. current skill gap).

- 70% of the respondents said that, if given the opportunity, they would be interested in pursuing the proposed METM degree. The summary is shown in the graph below -- *If you had the opportunity, would you consider pursuing ME in Technical Management?*



b. Secondary Data: Job Market Assessment/Analysis.

A secondary database research and analysis was conducted to identify the needs for technical managers. The statistics confirm the ample job opportunities expected for engineering careers in the nation and in Texas.

- USA. The Occupational Outlook Handbook of US Bureau of Labor Statistics shows many engineering job categories growing much faster than the total projected employment growth of 7%. In addition the Architectural and Engineering Managers jobs category is projected to grow at an annual rate of 7%. This shows a strong need for engineers and engineering/technical managers.

Engineering Employment Growth Outlook 2012-2022

Aerospace Engineers	7%
Biomedical Engineers	27%
Civil Engineers	20%
Electrical & Electronics Engineers	4%
Environmental Engineers	26%
Petroleum Engineers	15%

Source: http://www.bls.gov/ooh/architecture-and-engineering/home.htm

- Texas. The Texas Job outlook for engineers shows a stronger demand than the national average. With the projected engineering jobs growth in Texas, the need for engineering/technical managers will grow as well.

Texas Long-Term Employment Projections

Aerospace Engineers	14.0%
Biomedical Engineers	35.8%
Chemical Engineers	21.2%
Civil Engineers	30.5%
Computer Hardware Engineers	24.0%
Electrical Engineers	20.8%
Electronics Engineers, Ex. Computer	22.2%
Environmental Engineers	24.0%
Industrial Engineers	22.2%
Materials Engineers	17.3%
Mechanical Engineers	20.0%
Mining & Geological Engineers	29.9%
Petroleum Engineers	45.3%
Engineers, All Other	16.4%

Source: http://www.tracer2.com/publication.asp?PUBLICATIONID=826

c. Enrollment Projections – Use this table to show the estimated cumulative headcount and full-time student equivalent (FTSE) enrollment for the first five years of the program. (*Include majors only and consider attrition and graduation*.)

YEAR	**1**	**2**	**3**	**4**	**5**
Headcount	12	22	25	33	42
FTSE	10	18.3	20.8	27.5	35

d. Students

General recruitment efforts, including plans to recruit and retain students from underrepresented groups can be categorized as follows:

Industry Professionals:

As a professional master's program, the main recruitment efforts will be focused on recruiting industry professionals from technical fields such as oil & gas, energy, construction, manufacturing, electrical, electronics, plumbing & HVAC, systems integrators, and related channels. Professionals from engineering, design, sales, operations, technology and management will be ideal candidates. Efforts will be made to make sure the candidates have an appropriate bachelor's degree and sufficient industry knowledge and experience to make them successful in the TCMT program.

Industry Partnerships:

A concentrated effort will be taken to forge industry partnerships where the companies sponsor their top talent for the TCMT program. Capstone projects will be designed with the sponsors to bring value and innovation to the company and add competitive advantage.

Recruiting & Marketing Programs:

Based on the rich and successful experience within ETID with the Master of Industrial Distribution Program, the following recruiting and marketing programs will be developed:

- Print advertising: Industry related trade publications and engineering education journals.
- Electronic advertising: E-mails, banner ads and sponsorships in industry related trade publications and engineering education outlets and associations.
- Informational events & sessions: conduct admissions informational events in key cities to present, interact and recruit students.
- Corporate meetings and visits: Visit key partner companies to meet prospective students and company leadership sponsors.
- Educational institutions: Recruit faculty at multiple universities/colleges as well as academic conferences and events.
- Industry events, conferences and presentations: Participate in industry conferences, events and present the new TCMT program.

Academics

The highly integrated curriculum is designed in close collaboration and involvement with our industry partners to keep the program relevant for workplace needs for technical talents with business acumen. Our industry advisory boards' input will continually help hone the curriculum to ensure that the program stays relevant, leading-edge, and develops professionals who can be developed and grown into leadership positions.

Course Work

Prefix and Number	Required Courses
TCMT 601	**Engineering Leadership** - This course addresses Emotional Intelligence (EQ) and developing your cognitive, emotional, and behavioral capabilities so you will become an effective leader.
TCMT 611	**Financial Engineering** - This course covers financial engineering for technical managers, accounting and financial concepts provide every manager with a critical perspective on business performance and a foundation for good decision making.
TCMT 612	**Engineering Decision Making** - This course aims to bridge the gap by instilling a general intuition for data-driven decision making and equipping leaders with the tools and techniques necessary to analyze large databases and use effective data visualization to gauge key metrics.
TCMT 621	**Technical Project Management** – This course provides professionals with advanced tools and techniques to strategically execute projects, programs and portfolios
TCMT 622	**Contract & Risk Management** - An introduction to the principles of contract formation is presented highlighting the distinctive characteristics of

	contracting as well as the team concept for effective contracting and the role of the program manager as a key team member. Subcontract management, competitive negotiation techniques, contract financing, and cost reimbursement are also included.
TCMT 641	**Developing New Products and Services** - The purpose of this course is to position and detail new product and service development as critical business processes and through innovation, underpins sustainable growth, especially in new and emerging markets. As such, the course is particularly relevant for managers of innovation who are interested in exploring new products and services as an asset class and hence underpin market success for the organization, and its ecosystem
TCMT 644	**Leading & Managing Professional Teams** - This course examines the behavioral sciences relevant to the effective management of people and the effective design of human resources system, structure and policies. Topics include leadership, change management, motivation and pay systems, team dynamics, staffing, decision making, organizational communications, employee participation, performance appraisal, conflict management, negotiation, work design, organizational design, and organizations culture.
TCMT 651	**Engineering and the Value Chain** - This practice-oriented engineering and supply chain management course investigates a robust framework for better managing supply chains in today's rapidly changing markets. The course covers the next big trend in supply chain strategy, the key skills required to be successful, better structure a company's supply-chain strategy, guidelines for making strategic sourcing and make-buy decisions, and how to integrate e-business thinking into supply chain strategy and management.
TCMT 664	**Capstone Project I** - Students benefit from a one-on-one mentoring relationship with a top-level technology executive, matched to their professional interests and goals, over the course of the program. Students gain firsthand knowledge of the practices, experiences, and values of a successful technology management leader. Mentors are matched with students starting in the second year, at the conception of the Master's Project. Providing true executive guidance and advice, mentors work with their mentees through the final defense of the Master's Project and graduation.
TCMT 665	**Capstone Project II** - The Master's Project demonstrates students' ability to apply their coursework towards a specific technology solution based on the area of focus chosen by the student — usually in the form of a product or service — to a complex, real-world business challenge, objective, or scenario.

Uniqueness of the Program

There are three major uniqueness about the METM program in comparison with other similar programs across the nation.

1. **Experts** - Four courses are taught by experienced ETID faculty, two courses are co-taught by faculty and industry experts, and the remaining four courses are taught by industry professionals who understand industry and are eager to share their knowledge.
2. **Residency** – Two week-long and one three day residencies on Texas A&M campus to connect with fellow distance students, program faculty and staff support, traditions, and the larger Aggie network while taking part in challenging leadership workshops emphasizing communication, creativity, collaboration, problem solving, and formulating the capstone project.
3. **Lockstep** - Engage with a supportive cohort of like-minded professionals focused on enhancing their professional development while managing responsibilities at work and home.

Residency Week - The residency component is an essential part of a student's development and preparation for a career as a mid-level manager. The face-to-face sessions provide group discussions and debates so that students can challenge their own views and benefit from the diversity of ideas put forth by their colleagues. Students are provided access to executives who present contemporary issues facing the profession. The experience allows students to assess their own views and develop new perspectives on their leadership style. The residencies also offer students the opportunity to network with industry leaders, get to know fellow students from around the world, and build a lifelong network of alumni, mentors, and faculty from the program.

1. *First-Year Residency (Foundations)* -This residency initiates the TCMT program. Program introductions and updates are delivered, expectations are outlined, and students have the opportunity to experience the Aggie community. Highlights include distance technology/tooling overviews, workshops, faculty interaction, and social activities for TCMT cohort's students. The week covers emotional intelligence model for personal and professional leadership development. Social activities will further enhance relationship building amongst distance cohorts.
2. *Second-Year Residency (Explorations)* - This residency provides students an opportunity to reconnect personally with faculty and cohorts. Seminars and workshops focusing on professional development and business simulation activities will be required to supplement the remote classroom experience. Social activities during this residency will bring cohorts together for a final shared experience.
3. *Capstone/Graduation Residency (Reflections)* - The culmination of the TCMT program, this residency provides students the forum for final class presentations and assessments. Interactions, discussions, and feedback mark the integration of learning and application. Students participate in Aggie's graduation ceremonies alongside campus students.

Residency Week 2017 will be held August 13-17, 2018 in College Station, Texas.

Costs & Admissions

The 2018-2019 tuition rate for the METM program is $45,000 for in-state and $55,000 for out-of-state and international candidates. You must already hold an undergraduate degree from an ABET-accredited engineering program or one with equivalent standards. You must apply and be admitted to Texas A&M university graduate program.

Conclusions

The development process of the METM program has required many hours of efforts and commitment from the faculty, staff and administrators in the ETID department. Our biggest challenge will be recruiting new students with limited marketing resources available. Low enrollments in the first year is expected but our focus is on delivering a high quality program to industry. Our model of having industry experts teach some of the courses have received favorably by private industry. The residency program is very important to develop the networking and one-one interaction with the faculty, and the industry sponsored project is the highlight of the program.