

UMBC Engineering Management Program Review

External Reviewer Findings

1. The Review Process

The review was conducted by:

- Mr. Trevor Mackesey, Associate Teaching Professor and Director, MS in Engineering Management Program, Center for Leadership Education, Whiting School of Engineering, Johns Hopkins University
- Dr. Ashish D. Nimbarte, Professor & Chair, Graduate Program Coordinator, Industrial and Management Systems Engineering, West Virginia University

The review process relied on documentation provided by UMBC and interviews that were conducted on September 30, 2024. A draft report was compiled on the morning of October 1, 2024, with a final report submitted on October 11, 2024.

The reviewers were charged to focus on answering a set of questions provided by UMBC. These questions are addressed in detail in the section “Response to Specific Questions.” The reviewers were instructed not to limit the review to the questions. Sets of observations and recommendations are also provided.

1.1 Documentation Reviewed

The following documentation was provided in advance of the reviewers visit:

- UMBC Engineering Management Program Self-study
- Report Data for UMBC Engineering Management
- Administrative Structure-Engineering Management
- Engineering Management Syllabi
- Faculty CVs
- 2024 UMBC Engineering Management Survey
- Start-Stop-Continue Facilitators Guide

Additionally, the reviewers looked at online resources, such as UMBC school, CoEIT, and program websites, and external sites related to affiliate and peer programs, as well as ASEM.

1.2 Interviews Conducted

Interviews were conducted with:

- Ms. Peggy Re, Interim Vice Provost, Academic Affairs
- Dr. Marc Olano, Associate Dean, College of Engineering and Information Technology
- Dr. Jeffrey Halverson, Interim Vice Provost and Dean of the Graduate School
- Dr. Maria Sanchez, Director, Engineering and Computing Education Program
- Dr. Toby Gouker, Graduate Program Director, Professional Engineering Programs
- Dr. Christopher Steele, Vice Provost, Division of Professional Studies
- Ms. Kim Edmonds, Assistant Director, Division of Professional Studies

- Ms. Allison Jones, Assistant Vice Provost, Division of Professional Studies
- Mr. Jonathan Jett-Parmer, Assistant Graduate Program Director, Engineering and Computing Education Program
- Dr. Jeff Ray, Adjunct III, Engineering and Computing Education Program
- Chris [last name unknown], Adjunct I, Engineering and Computing Education Program
- Mr. Pratik Chokhane, Engineering Management Student
- Mr. Anurag Chaturvedi, Engineering Management Student
- Mr. Devarsh Wali, Engineering Management Student

2. General Program Description

The Engineering Management (EM) programs at UMBC, reside within the Engineering and Computing Education Program (ECEP) in the College of Engineering and Information Technology (COEIT), and they are offered under a Memorandum of Understanding between CoEIT and the Division of Professional Studies (DPS). The EM programs include two MS degrees and three post-baccalaureate certificate (PBC) programs, which were primarily designed to provide practicing engineers and technology professionals with the fundamentals of management and leadership. These programs are course-based, non-thesis programs, and there are no research elements for these programs.

Dr. Toby R. Gouker, Graduate Program Director (GPD), along with the newly appointed Assistant GPD Professor Jonathan Jett-Parmer, run the program and receive necessary administrative support from DPS and ECEP.

As of fall 2014, 157 students are enrolled in the program—around 85% international and the remaining 15% in-state, domestic students.

3. General Comments/Observations

The program is run with professionalism and a dedication to student success. Faculty and staff are focused on providing students with a value adding, constructive learning environment that positions students to achieve their professional goals. All indications are that the students in the program are satisfied with their educational experience. Based on the review, we believe that the positive outcomes are due in large part to the dedication and commitment of the individuals teaching in and working for the program.

The greatest opportunity for improvement lies with continuing adjustments to reflect the increased number of students, new student demographics, and emerging trends in industry.

3.1 Observation 1: Increased Enrollment and Demographic Shift

The size of the EM program has quadrupled over the past two years, mirroring growth in other programs at UMBC. However, the university infrastructure is still adapting to the large influx of international students. The influx of international students created additional challenges, as the program faculty, and especially the support staff, received minimal to no training on providing necessary support [academic (for example, writing requirements) and social issues (sense of belonging, engagement, etc.)] to the international students. The influx of international students also created a massive imbalance between local and international students. Infrastructure readiness needs to be critically reevaluated to ensure that

the program can effectively support the current level of enrollment and that future growth in number of students, both domestic and international, is sustainable.

3.2 Observation 2: Strengths and Vulnerability of Reliance on Adjunct Faculty

Beyond courses taught by the GPD and Assistant GPD, the program's teaching needs are met by an adjunct faculty largely composed of working professionals in the region. These faculty bring a wealth of professional knowledge and experience, attributes that are recognized and appreciated by EM students. We were particularly impressed by the dedication many of the adjunct faculty have shown to the program and their students, as indicated by the length of time they have taught for the program, number of classes taught, and contributions beyond course creation and teaching requirements. This dedication should be recognized and supported.

While overall the adjunct faculty should be viewed as a distinguishing strength of the program, it is also a vulnerability, particularly at the program's new scale. The reviewers advise identifying key contributors, offering recognition and support beyond the level of GPD and Assistant GPD, and engaging in succession planning. The reviewers also advise reviving the advisory panel that was active before the pandemic and planning at least one event per semester where all adjunct faculty are invited to foster a sense of community, receive recognition for their contributions, and share best practices.

4. Response to Review Questions

This section serves as a direct response to the ten standard program review questions and two program specific review questions provided before the visit.

4.1 Question A: General Goals and Objectives

"Please comment on the appropriateness of general goals and specific objectives of the program. How are they being met?"

Based on the curriculum, course descriptions, and self-study provided, the Engineering Management program is designed to meet the current stated goals, which are to:

- I. Lead and manage effectively in technical organizations,
- II. Make sound decisions using technical, business, and ethical factors,
- III. Effectively communicate technical concepts to non-technical audiences.

These goals are met through focused graduate courses in management supplemented with electives in engineering and management, ensuring comprehensive exposure. The program also employs an adjunct faculty with an impressive range of professional experience, allowing for the transmission of program goals through lectures, discussions, activities, assignments, and projects that promote both theory and practice.

Additionally, the program learning outcomes are to:

- I PLO-IA:** Demonstrate the ability to effectively manage a project's cost, schedule, technical performance, and risk.

- I **PLO-IB:** Apply management, leadership, communication, and interpersonal skills to deal with others effectively.
- II **PLO-IIA:** Apply sound professional and ethical standards to decision making.
- II **PLO-IIB:** Analyze and apply company financial information to make effective decisions.
- III **PLO-III:** Demonstrate the ability to effectively communicate technical concepts to technical staff and management.

While it is the reviewers' perspective that the required courses ensure that the learning outcomes are met for all students, it is of note that the different "pathways" offered can have a significant impact on the depth of exploration of the above outcomes and the breadth of additional learning objectives and outcomes.

Overall, the inclusion of specified pathways can be seen as a strength of the program as the pathways are clearly defined, relevant to in-demand skills and knowledge associated with professional work and offer students a clear means of navigating their time in the program and articulating a cohesive story to potential employers. In considering any future pathways, the reviewers encourage the program to ensure sufficient technical rigor to continue to delineate the program graduates from those graduating with business degrees.

4.2 Question B: Students' Perception

"What is the students' perception of the quality of the program and their evaluations of the faculty's teaching and mentoring?"

The reviewers did not have extensive information on which to develop a conclusive response to this question, but it is possible to infer meaningful feedback based on course evaluations, student surveys, and a lunch interview conducted with three current students.

Student Evaluation of Educational Quality (SEEQ) shows an overall positive response, with an average "overall rating" of 3.89 since Spring 2022 (Self-study 21). The survey conducted in Spring 2024 indicated that 86% of students are satisfied with their overall learning experience (Self-study 24), a sentiment that was echoed by all three students who joined the reviewers for lunch.

While the three students who were interviewed all found the faculty's professional experience inspirational and relevant to their career goals, there was mention of a desire for more activities for program members beyond coursework, which might suggest a desire for additional mentoring. This would need to be investigated further.

The program remains made up of at least two distinct populations of students: younger foreign students and local practicing engineers, with a possible third group emerging of UMBC graduates transitioning to the program directly from their undergraduate studies. It would have been more informative to have all groups well represented for a better discussion, and we encourage additional conversations, group discussions, and surveys to better understand the current makeup of student populations. While we did not see the data firsthand, it was encouraging to discover that exit interviews are already conducted by DPS, suggesting the program's commitment to meeting student expectations.

4.3 Question C: Proposed Directions of Growth

“Are the proposed directions of growth of the program consistent with the nature, mission, and overall plans and priorities of the College and the University? Please comment on the overall quality of the program relative to its aspirational peers.”

The mission of UMBC’s College of Engineering and Information Technology is:

- to educate future leaders and contribute to the professional workforce in engineering, computer science, and information systems;
- to excel in research and innovation that discovers new knowledge and enables new technologies and systems; and
- to embrace a culture of service to and engagement with our communities and professions.

Without question, the Engineering Management program is contributing to COEIT’s mission of educating future leaders and contributing to the professional workforce, and there appear to be specific courses that contribute to the other aspects of the mission as well.

Furthermore, all parties interviewed agreed with the impressive growth and contributions of the Engineering Management program and the need to focus on stabilization rather than growth in the near future. With this in mind, the reviewers suggest that growth, at least over the next few years, is explored as a means of maintaining the program’s strength and relevance, not an increase in enrollments. One example would be the proposed Global Engineering Management pathway, discussed in the recommendations at the end of this report. Another example would be to focus on growing specific student-segments to increase diversity. Without question, the international students bring new perspectives, energy, and academic achievements to the program; it is important that these contributions add to the pre-pandemic strengths of the program’s student body without supplanting them.

4.4 Question D: Teaching Materials and Methods

“What is the quality of the curriculum? Do teaching materials and pedagogical methods reflect state of the art within particular areas?”

Teaching materials are current and similar to those used at other programs, and the directors and two faculty members interviewed take pride in continuously updating their materials based on personal study, professional work, and feedback from personal networks relevant to courses taught.

While the pedagogical methods presented to the reviewers through the self-study, interviews, and observations were not necessarily state of the art, they were in line with best practices from other successful engineering management programs and well planned, structured, and articulated. They also included components that are expected in modern pedagogical approaches, including the use of flipped classrooms, a range of teaching modalities within single courses, and group projects designed to mirror the collaborative nature of the professional roles students hope to attain.

The two areas that could be viewed as state of the art are the use of Quality Matters reviews of online courses by some faculty and the industry-specific knowledge incorporated in the curriculum by adjunct faculty working in industry.

4.5 Question E: Quality of the Curriculum

“Considering the program’s assessment of student learning outcomes, discuss ways the faculty might most effectively “close the loop” by enhancing its use of the outcomes of assessment to improve teaching and learning.”

Given the explosive growth of the Engineering Management program, the reliance on new adjunct faculty, and the disruption of the pandemic, the reviewers were impressed by not only the program’s focus on maintaining the quality of the curriculum, but also the effort to implement clear processes to do so. Most noticeably, some instructors in the program have opted into use of the Quality Matters review process to deliver better course design, making navigation easier for students, reducing barriers to student achievement, and resulting in better outcomes. This process can represent a significant increase in faculty effort and shows a dedication to going beyond maintaining the quality of the program to improving it, with additional benefits for online teaching where there is an added reliance on technology and additional communication channels.

The current structure of the curriculum, that combines management and technical or engineering courses supplemented by electives, pathways, and certificates, has the potential to be relevant to working professionals, international students with one-to-three years of work experience, and recent UMBC graduates. While it is largely the customization allowed by the electives, pathways, and certificates that allow the program to serve the different demographics, it also increases the need for informed, early advising.

In short, the curriculum is robust and relevant; to continue serving different student populations, the program needs to continue its efforts to increase academic and professional advising that is relevant to all student populations, and the reviewers strongly recommend that the university provide the program with additional resources to do so. International students and students entering the program directly following undergraduate graduate education require more resources and advising similar to what is already being provided to the UMBC undergraduate population.

4.6 Question F: Scholarly work

“Is the level of scholarly work by faculty members in the program suitable for this program? Does the program as operating or planned provide sufficient opportunities for continued growth in quality of scholarship, creativity of faculty, and research opportunities for students?”

The Engineering Management Programs at UMBC, which include two MS degrees and three postbaccalaureate certificate (PBC) programs, are primarily designed to provide practicing engineers and technology professionals with the fundamentals of management and leadership. These programs are course-based, non-thesis programs, and there are no research elements for these programs. The program directors are tasked with teaching and have extensive program administration responsibilities, and there is little to no scope for scholarly work.

Furthermore, the sudden influx of international students due to the COVID backlog created additional challenges for the program directors to provide the necessary support to the active students, leaving very little scope for either attending to or enhancing the pedagogical creativity and overall research

opportunities for the students. During the reviewers meeting with a small group of students, some interest was judged among the students for having research opportunities. Exploring the options for providing research opportunities to the students may be worthwhile and may provide opportunities for the program and its students to better collaborate with other programs at UMBC to further support UMBC's recently acquired R1 status.

4.7 Question G: Facilities

"Please comment on the adequacy of the program's facilities for fulfilling its goals."

The Engineering Management programs only uses classrooms; no research is being conducted, and therefore, no lab space is required. Furthermore, the program utilization of adjunct faculty alleviates the need for office space. However, the recent growth in the program has presented untimely classroom allocation problems. There have been delays in classroom assignments over the past few semesters, which have delayed students from signing up for some courses and have led to unnecessary levels of anxiety. Eventually, classrooms have been found for all offerings, but not without a significant level of creativity. Part of the reason for this issue may be the decentralized administrative process used for the classroom assignment. It is recommended that the administrative processes be analyzed and improved to prevent future occurrences.

4.8 Question H: Utilization of Resources

"Given your review, do you think the program resources are being used effectively? Are there other ways you can suggest for them to be used? Are there additional ways the program might generate revenue?"

The Engineering Management programs do not have a direct budget line. The program resides within the Engineering and Computing Education Program (ECEP) in the College of Engineering and Information Technology (COEIT), and it is offered under a Memorandum of Understanding between the COEIT and the Division of Professional Studies (DPS). DPS covers program directors' and instructors' salaries and expenses, administrative program support, and marketing expenses. The ECEP makes the funding available to meet the emerging needs of the program, including but not limited to providing the necessary resources to support the professional development of the faculty. To date, any such requests made by the program directors for resources have been met by administrative support in ECEP.

The program is reported to be self-sufficient and may have generated additional net revenue considering the recent upward trends in enrollment, which quadrupled the program size over the past two years. Overall, the existing resource allocation models appear to work well for the EM programs.

4.9 Question I: Collaborate with other units of the University

"To what extent does or should the program collaborate with other units of the University?"

As noted in response to *Question 4.6*, unlike many other COEIT programs, the Engineering Management programs lacks research elements, limiting its ability to actively collaborate with other programs. However, the EM program directors routinely engage with various COEIT programs to educate the students about EM program offerings; for example, the program director makes presentations at the multi-disciplinary Capstone class within COEIT, which provides opportunities for Engineering Management to collaborate/market their program to prospective students.

4.10 Question J: Program needs

“With regard to any resources identified as needed in the self-study or the external evaluation, which one is most urgent and/or most likely to benefit the program and how?”

Although no resources were identified in the self-study, based on the reviewers' discussion during lunch meeting with the current students, it is recommended to investigate allocating resources to the following initiatives to improve the program:

- *Enhance product management course offerings*, given that product management is one of the critical career paths for Engineering Management graduates, the course offerings in this area can be enhanced.
- *Provide financial incentives to students to pursue third-party certification*. Third-party certification provides students with opportunities to learn about the industry's ongoing trends. Such certificates also serve as a resume booster. The average cost for such certificates ranges from \$200 to \$300.
- *Provide a venue for the graduate students to meet and interact with fellow students and industry experts (guest speakers)* to facilitate the sharing of ideas and to learn and discuss ongoing industry trends.
- *Enhance outreach with local industries*. Direct connections with local industry are no longer the same as before COVID; outreach can be enhanced to connect with working professionals in the region who may benefit from career growth opportunities presented by the Engineering Management programs.

4.11 Program-specific Question 1: ASEM Certification

“Should the program consider seeking an ASEM certification?”

The ASEM certification would generally benefit the program; however, more data (student feedback, advisory panel feedback, etc.) would be necessary to determine its importance to the program stakeholders. Furthermore, pursuing such certification would require curriculum modification, requiring creating/adding core courses to provide coverage for the various topics covered in the ASEM body of knowledge. This may put an additional burden on the program directors and may also involve changing the current 5 core + 5 elective structure. In summary, careful consideration of the faculty resources available, overall curriculum-related changes required for the certification, and most importantly, the interest among the students should be re-assessed before deciding to seek the ASEM certification.

4.12 Program-specific Question 2: Global Engineering Management Track

“Should the program develop a global engineering management track?”

After conducting interviews, the reviewers strongly recommend that the program pursue a global engineering management track or pathway. At first, the reviewers were skeptical of any differentiation between a Global Engineering Management focus and the skills required by all engineering managers. However, a Global Engineering Management track or pathway makes sense when viewed as a means of differentiation with the potential to be attractive to international students, domestic students with a desire for more international exposure, and companies with an international presence.

Furthermore, the program already offers a suite of courses that could be linked to create the new Global Engineering Management track, and, as a track, it would avoid the need for a difficult and lengthy approval process. Examples of relevant courses include but are not limited to: ENMG 661 Leading Virtual Teams, ENMG 667 DEI Mindset in Technical Project Management, ENMG 680 International Project Management, ECEP 405 Global Engineering.

To make sure the implementation is carried out effectively, the reviewers advise the program to conduct focus groups with current students and undergraduate students in relative courses to test desirability, while also having conversations with industry connections to ensure appropriate learning outcomes. If implemented, the reviewers also recommend that the university allocate resources to market the new track, initially focusing efforts on building relationships with several international universities and UMBC undergraduate courses with coursework that aligns with the Global Engineering Management track.

5. Reviewer Recommendations

While the program director, assistant director, faculty, and staff have done an exceptional job adapting to increased enrollment and demographic shifts, the reviewers make the following recommendations to aid in current stabilization efforts.

5.1 Recommendation 1: Review, Adjust, and Augment Resources and Initiatives for International and Accelerated Master's Students

Since the pandemic, the Engineering Management program has not only experienced explosive growth, it has also undergone an extreme demographic shift from domestic students with professional experience to international students with less professional experience. The program has also accepted small cohorts of accelerated master's students, a trend that could be expanded to adhere to the university's vision, increase program diversity, create cultural ambassadors within the program, and deepen the connection of UMBC bachelor's graduates to the university.

While these new pipelines of potential students present exciting opportunities for the program, they also require different, and often more, resources than working professionals. We advise that the program review, adjust, and amend the following resources and initiatives:

- **Academic Advising** – Without the same professional experience and knowledge of the US job market and professional culture, these students will require more and consistent direction in course selection.
- **Career Advising** – Without the same professional experience and knowledge of the US job market and professional culture, these students will require more and consistent direction in job readiness training and career counseling. Additionally, the school will need to make additional effort to identify—and perhaps educate—companies willing to provide internships and ultimately jobs to international applicants.
- **Recruiting** – Focus on building partnerships with select international schools linked to successful program alumni and undergraduate UMBC instructors teaching related coursework, to offer focused presentations and discussions about the program.
- **Engagement** – Foster engagement and strengthen the Engineering Management community by providing at least one event per month during the academic year that is open to current

students, alumni, and faculty. Consider whether some of these events would also be relevant to prospective students and industry partners.

- **Training** – Offer training to existing faculty and staff that covers cultural awareness and best practices related to the emergent program demographics.

5.2 Recommendation 2: Implement and Test a New Pathway in Global Engineering Management

A new Global Engineering Management pathway has the potential to be attractive to international students, domestic students with a desire for more international exposure, and companies with an international presence. It also has the potential to act as a differentiating factor of the program and, given current course offerings, would require minimal investment beyond promotion.

For next steps, the reviewers recommend:

- Define learning objectives for the new Global Engineering Management pathway in consultation with faculty or advisory panel members who have worked on multinational teams involving engineers.
- Identify current courses that align with a global engineering management focus.
 - To start, the program currently offers ENMG 661 Leading Virtual Teams, ENMG 667 DEI Mindset in Technical Project Management, ENMG 680 International Project Management, and the undergraduate course, ECEP 405 Global Engineering.
- Identify gaps after mapping existing courses to the learning objectives and consider new courses that might need to be developed.
- Update website and create promotional materials.
- Identify several international schools and UMBC undergraduate courses for targeted information sessions. It may be helpful to employ current, second-year students to help with promotion.

5.3 Recommendation 3: Recognize Adjunct Faculty for their Contributions

The knowledge, experience, and dedication the adjunct faculty bring to the Engineering Management programs is both a distinguishing factor of the program and a large part of the reason it has been able to respond as well as it has to the increased enrollment (staff support from DPS is another reason). We believe the current GPD has done an amazing job recruiting this faculty and keeping them connected, and we strongly recommend building on these efforts by finding additional ways to offer institutional support.

Support that should be considered:

- Streamlining the promotion process and making the requirements for promotion between Adjunct II and Adjunct III less dependent on unpaid, non-teaching contributions. This recommendation is based on multiple interviews, as the reviewers could not find clear criteria on the university website for the promotion from Adjunct II to Adjunct III.
- Sending an institutional acknowledgement of service to adjuncts who have worked with the program for more than a defined period.
- Hosting an event to acknowledge adjunct faculty contributions and reinforce community.

6. Conclusion

UMBC should be proud of its Engineering Management program for how it meets the visions of the university and the College of Engineering and Information Technology. The administrators, faculty, and staff are engaged and committed to delivering a quality education and experience to the students enrolled in the program and its associated certificates.

All Engineering Management program stakeholders that were interviewed appeared committed to meeting the needs of students. If the university can learn from the support it currently offers its undergraduate student population and apply best practices to supporting different demographics of master's students, we look forward to seeing what the program is able to accomplish.