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Curricular Articulation of Leadership and Organizational Behavior in Professional Graduate Engineering Management Programs

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Abstract

Graduate Engineering Management (EM) programs are intended to support engineers transitioning from individual technical contributors to leadership roles involving responsibility for people, projects, and complex socio-technical systems. Leadership and organizational behavior are, therefore, central components of EM curricula. Because these domains are also emphasized in Master of Business Administration (MBA) programs, questions arise regarding how leadership and organizational behavior are framed specifically for engineers and how EM programs distinguish engineering leadership from general managerial capability. This paper examines how leadership and organizational behavior are represented in graduate EM curricula focused on professional leadership development. Using an exploratory qualitative curriculum analysis, the study examines how leadership-related competencies are articulated at both the program and course levels, drawing on publicly available program descriptions and course catalog materials. Rather than evaluating instructional effectiveness or program quality, the analysis focuses on curricular representation and framing. Specifically, it examines whether leadership topics are presented as technical decision-making within engineering and socio-technical systems, implicitly embedded within technically oriented coursework, or framed more broadly using managerial or organizational constructs. Concepts from the Engineering Management Body of Knowledge (EMBoK) are used as an interpretive lens to inform analysis of technical leadership, systems integration, and socio-technical responsibility, without assessing formal alignment with any certification framework. The findings reveal recurring patterns in how leadership and organizational behavior are communicated across graduate EM curricula, including variation in the explicitness with which engineering-centered leadership is articulated. The results offer insight into how EM programs communicate leadership expectations to prospective students and highlight opportunities for clearer curricular differentiation within professional engineering education.

1. Introduction

Engineering Management (EM) occupies a distinctive position within professional graduate education. Graduate EM programs are designed to support engineers as they transition from individual technical contributors to roles involving responsibility for projects, people, and complex socio-technical systems. In this context, leadership and organizational behavior are not peripheral subjects but central components of professional formation.

EM programs serve a specific professional audience: engineers whose foundational training is grounded in technical problem-solving, systems analysis, and quantitative reasoning. As engineers assume expanded organizational responsibilities, the framing of leadership and organizational behavior within EM curricula contributes to how professional identity evolves and how expectations for engineering leadership are communicated. The Engineering Management Body of Knowledge (EMBoK), maintained by the American Society for Engineering Management (ASEM), provides a formal reference framework outlining the technical, managerial, and leadership domains that define the field's professional scope [1]. While EM programs vary institutionally, the EMBoK reflects the discipline's effort to articulate a coherent professional identity that integrates engineering expertise with organizational leadership and management practice.

Leadership and organizational behavior education are not unique to EM. Comparable themes are prominent in Master of Business Administration (MBA) programs and other management-oriented graduate degrees. MBA programs, however, are highly diverse in emphasis, structure, and institutional mission. Because MBA programs are heterogeneous and not organized around a unified professional body of knowledge, direct comparisons must be approached cautiously. Rather than positioning EM in contrast to MBA education, this study examines how EM programs articulate leadership and organizational behavior within their professional contexts. Specifically, it analyzes how these themes are represented and framed in publicly available program descriptions and required course materials, and how such representations signal the integration of engineering and managerial perspectives. MBA programs provide useful contextual reference, but they are not the focus of the present analysis.

Graduate EM education represents a critical transition point in professional development. At this stage, leadership is often framed as technical decision-making authority within engineering systems. In contrast, organizational behavior may be understood as the study of the influence of team dynamics, organizational structures, and enterprise processes. Alternatively, programs may present these elements as integrated aspects of engineering practice. The language used in program descriptions and required course materials serves as an institutional expression of curricular intent and communicates how programs conceptualize leadership and organizational capability for engineers.

To support interpretation, this study draws on the literature on disciplinary identity, professional jurisdiction, and engineering leadership development. These perspectives provide a conceptual lens for examining curricular language without presuming normative conclusions about instructional effectiveness or program quality. Rather than evaluating outcomes or accreditation compliance, this study focuses on representation: how leadership and organizational behavior are described and positioned within graduate EM curricula.

Using an exploratory qualitative curriculum analysis of a purposive sample of ASEM-certified graduate EM programs, this research analyzes publicly available program descriptions and required course catalog materials to identify recurring patterns in the framing of leadership and organizational behavior. Three research questions guide the study (see Research Questions). By examining curricular framing rather than instructional practice, this work contributes to ongoing discussions within the ASEE Engineering Management Division regarding curriculum coherence, professional identity, and leadership preparation in engineering-intensive environments.

2. Background and Related Research

2.1 Disciplinary Context and Professional Identity

Engineering Management (EM) education operates at the intersection of engineering practice and organizational leadership. Understanding how leadership is framed within EM curricula requires attention to the academic disciplines that inform professional education. Becher and Trowler describe academic disciplines as “tribes” that develop distinct intellectual cultures, norms, and epistemological orientations. Engineering is typically characterized as a “hard applied” discipline, emphasizing analytical rigor, technical problem solving, and solution-oriented reasoning [2]. Management and business education are often described as “soft applied,” oriented toward contextual judgment, organizational interpretation, and relational dynamics.

These distinctions are descriptive rather than hierarchical. Abbott’s theory of professional jurisdiction further suggests that professions establish and maintain legitimacy by defining and framing their areas of

expertise [3]. In graduate professional education, curricular language functions as a visible mechanism for signaling such positioning. Whether leadership is framed as technical decision-making authority within engineering systems, as organizational oversight, or as an explicit integration of both affects how programs define their professional identity.

The present study does not assume inherent conflict between engineering and management disciplines. Rather, it examines how EM programs operate within an interdisciplinary space that incorporates elements of both. The focus is therefore on curricular representation and professional signaling rather than on disciplinary competition or boundary defense.

2.2 Leadership

Leadership and organizational behavior are central components of MBA and EM programs. However, MBA education is highly heterogeneous. Programs vary widely in structure, specialization, pedagogical philosophy, and institutional mission. Contemporary MBA curricula include concentrations in technology management, entrepreneurship, analytics, finance, sustainability, and global leadership, among others [4], [5]. Industry reporting likewise reflects continued diversification and adaptation of MBA programs in response to globalization and evolving employer expectations [6].

Scholarly critiques of MBA education have historically centered on concerns about an overemphasis on analytical frameworks at the expense of experiential learning and professional formation [7,8]. More recent work, however, suggests that many MBA programs have responded through curricular reform, greater integration of experiential learning, and attention to leadership development [5,9]. Leadership education research within business schools increasingly incorporates adult learning theory, coaching models, and competency-based approaches [10,11].

Unlike EM, which the EMBoK supports as a formal professional reference framework, MBA education is not organized around a single, unified disciplinary body of knowledge. Instead, MBA programs reflect diverse interpretations of management education shaped by accreditation bodies (e.g., AACSB, EQUIS, AMBA, and ACBSP), institutional priorities, and market positioning.

Leadership models in business contexts often emphasize organizational strategy, managerial influence, interpersonal effectiveness, and enterprise-level coordination. This heterogeneity in MBA education provides a useful context, but it does not offer a single comparative baseline for EM curricular analysis. The question for EM education is not whether these elements are appropriate, but how they are integrated with engineering-centered professional expectations. Addressing this integration requires examining how engineering leadership itself is conceptualized in the literature.

2.3 Engineering Leadership as Socio-technical Integration

Recent research in engineering education conceptualizes leadership not as a generic transferable skill but as an integrated component of engineering professional identity. Rottmann, Sacks, and Reeve argue that engineering leadership blends recognized forms of influence with engineers' technical identities [12]. Chan similarly demonstrates that engineers in leadership roles retain technical dimensions of their professional identities, even when operating in less engineering-intensive sectors [13]. Together, these findings suggest that effective engineering leadership is grounded in technical credibility and systems-level accountability rather than in abstraction from technical work.

In this context, *socio-technical* refers to the interdependent relationship between technical systems, such as engineering design, infrastructure, processes, and technologies, and social systems, including teams, organizational structures, communication patterns, and decision-making processes. Engineering leadership, therefore, operates in environments where technical performance and organizational coordination are inseparable.

Schell and Hughes further describe engineering leadership identity as emerging at the intersection of engineering and leadership domains [14,15]. Their work, along with broader research within the ASEE Engineering Leadership Development community, emphasizes socio-technical integration, authentic practice contexts, and professional identity formation [16-18]. Leadership development in engineering is thus understood as expanding the scope of technical responsibility to include the coordination of people, projects, and complex systems.

Trevelyan characterizes engineering practice itself as inherently socio-technical, requiring continual coordination between technical tasks and organizational dynamics [19]. From this perspective, graduate EM programs must articulate leadership in ways that reflect this integration, connecting organizational and behavioral concepts to engineering judgment, risk analysis, project execution, and ethical responsibility.

2.4 Curricular Framing and Professional Signaling

Building on the disciplinary and identity perspectives outlined above, publicly available curricular artifacts serve as signals of professional orientation. The language used to describe leadership and organizational behavior communicates how programs conceptualize the relationship between engineering expertise and organizational responsibility.

Higher education research has noted that market pressures and interdisciplinary convergence can influence how professional programs frame themselves [20]. In interdisciplinary fields such as EM, examining curricular language provides insight into how programs integrate business-domain knowledge while maintaining alignment with engineering-centered professional identity.

This study, therefore, examines how graduate EM programs articulate leadership and organizational behavior within their official curricula. Rather than presuming convergence with or divergence from MBA models, the analysis focuses on patterns of representation, specifically whether leadership is framed primarily as technical accountability within engineering systems, as organizational management, or as an explicit integration of both perspectives.

By grounding the analysis in the literature on disciplinary identity and professional education, this study provides a conceptual lens for interpreting curricular language while remaining proportionate to the scope of the data examined.

3. Research Questions

This study examines how graduate EM programs articulate leadership and organizational behavior within their declared curricula. Rather than evaluating instructional effectiveness or student outcomes, the study examines how leadership-related competencies are formally represented in publicly available descriptions and required coursework.

The following questions guide the research:

RQ1. How are leadership and organizational behavior articulated in publicly available program-level descriptions of graduate Engineering Management programs?

RQ2. How are leadership and organizational behavior framed within required courses addressing these themes in graduate EM curricula?

RQ3. What patterns emerge in the way graduate EM programs represent the relationship between engineering-centered and managerial perspectives in leadership and organizational behavior?

Collectively, these research questions emphasize curricular representation and professional identity signaling rather than instructional delivery or assessment of learning outcomes.

4. Methodology

4.1 Study Design

This study employs an exploratory qualitative curriculum analysis to examine how leadership and organizational behavior are framed within graduate EM curricula oriented towards professional leadership development. The analysis focuses on *curricular representation* rather than instructional practice, student outcomes, or program effectiveness. Specifically, the study examines how leadership-related concepts are formally articulated through program descriptions and course catalog materials that define the declared curriculum.

An exploratory qualitative design is appropriate given the study's emphasis on identifying patterns of curricular framing and disciplinary positioning rather than testing hypotheses or evaluating compliance with accreditation standards. This approach aligns with established practices in engineering education research, where curriculum artifacts are analyzed to investigate professional identity formation and learning priorities across interdisciplinary domains.

4.2 Data Sources

The data for this study consist of publicly available curriculum artifacts drawn from graduate Engineering Management programs. These artifacts include: (1) Program-level descriptions (e.g., program overviews, stated objectives, and mission language); and (2) Course catalog descriptions for required leadership- or management-related courses.

These materials were selected because they represent official, institutionally vetted expressions of curricular intent and serve as primary signals to prospective students, faculty, and external stakeholders. While course syllabi may provide additional instructional detail, program and catalog descriptions offer a stable and comparable basis for examining how leadership and organizational behavior are positioned within EM curricula across institutions.

4.3 Program and Course Selection

Programs were selected using purposive sampling to capture variation in institutional context, delivery format, and leadership articulation, while maintaining coherence across degree levels and professional intent.

The sample (n = 7 programs) was drawn from the fifteen ASEM-certified graduate EM programs listed at the time of data collection [21]. Programs were selected to reflect variation in institutional type, geographic region, delivery format (traditional vs. executive), and degree structure. Selection continued until additional programs did not introduce substantively new patterns in the framing of leadership and organizational behavior, as observed in program- and course-level descriptions.

For each selected program, the following artifacts were collected:

1. A program-level description outlining curricular goals and leadership emphasis.
2. Required or core course descriptions addressing engineering management, leadership, organizational behavior, decision-making, or project-based leadership.

Course inclusion criteria were derived from the study's conceptual focus and informed by leadership and engineering management literature reviewed in Section 2. Courses were included if their titles or catalog descriptions referenced leadership, organizational behavior, management of technical work, team coordination, socio-technical systems, engineering decision-making, or related themes that signal formal attention to professional leadership development within engineering contexts. These terms were selected because they represent recurring conceptual elements identified in engineering leadership scholarship and EM professional frameworks.

Selection continued until additional programs did not introduce substantively new framing patterns across the defined analytical dimensions, including leadership perspective (engineering-centered, managerial-centered, or hybrid), explicitness of leadership articulation, and organizational behavior orientation; saturation was determined when subsequent cases reinforced existing categories rather than extending or modifying the coding framework.

For comparability across institutions, the analysis focused on the one required or core course per program that most directly and explicitly addressed leadership or organizational behavior themes, as indicated by catalog descriptions. Additional relevant required courses were reviewed to inform interpretation; however, they were not tabulated separately.

4.4 Analytical Framework

Curriculum artifacts were analyzed using a thematic coding framework focused on how leadership and organizational behavior are framed within EM education. Drawing on literature reviewed and professional perspectives on EM practice, the analysis examined curricular language across five interpretive dimensions:

1. Leadership Context: Whether leadership was framed primarily within engineering and technical environments, broader organizational settings, or as an explicit integration of both.
2. Leadership Framing: Whether leadership was presented as (1) technical decision-making and accountability within engineering systems; (2) managerial oversight of people, processes, or resources; or (3) implicitly embedded within technical or systems-oriented coursework.
3. Organizational Behavior Framing: Whether organizational behavior was positioned primarily in socio-technical engineering contexts, general organizational dynamics, or hybrid settings that integrated both perspectives.

4. Systems Orientation: The extent to which curricular language explicitly referenced systems thinking, socio-technical integration, technical systems, or cross-functional coordination, or implicitly embedded these concepts within descriptions of engineering management practice.
5. Instructional Emphasis (Inferred): The extent to which course descriptions suggested emphasis on analytical tools, conceptual frameworks, applied project work, or professional practice contexts. Because full syllabi were not analyzed, this dimension reflects language cues in catalog descriptions rather than confirmed pedagogical methods.

The first three dimensions were most central to the comparative findings presented in Tables 1 and 2 in the results section. Systems Orientation and Instructional Emphasis were used primarily as supporting interpretive dimensions to strengthen coding consistency, cross-case comparison, and narrative synthesis.

Each dimension was coded using a three-level interpretive scale (e.g., engineering-centered, hybrid, managerial-centered) to capture qualitative distinctions without imposing false precision or numerical ranking. Coding was iterative and interpretive, with categories refined through repeated comparison across institutions. The purpose of the framework was descriptive comparison rather than evaluative assessment.

4.5 Coding Procedure

All program- and course-level artifacts were coded independently by the authors. Coding decisions were grounded in explicit language from curriculum materials, with brief excerpts or paraphrased evidence documented to support each classification.

Given the exploratory qualitative design and the limited number of artifacts analyzed, formal statistical measures of inter-rater reliability were not employed. Instead, interpretive agreement was established through structured discussion and documented justification of coding decisions.

4.6 Data Analysis and Synthesis

Analysis proceeded in three stages:

1. Artifact-Level Analysis: Each program description and course description was analyzed individually to identify leadership and organizational behavior framing patterns.
2. Within-Program Comparison: Program-level framing was compared with course-level framing to examine alignment, reinforcement, or ambiguity within each curriculum.
3. Cross-Program Pattern Identification: Patterns were examined across programs to identify common approaches to leadership articulation, variation in explicit versus implicit framing, and differences in how technical and organizational leadership were integrated.

Findings are reported descriptively, through thematic summaries and comparative tables, rather than through numerical aggregation or formal ranking.

4.7 Methodological Limitations

This study is subject to several limitations. First, the analysis relies on publicly available program and course descriptions, which reflect intended curricular framing rather than enacted pedagogy or classroom practice. Second, the study focuses on curricular representation rather than learning outcomes, student

experiences, or graduate career trajectories. Third, the sample is limited to a purposive subset of ASEM-certified graduate EM programs and does not capture the full diversity of EM programs or alternative models of management education.

Despite these limitations, the methodology provides meaningful insight into how leadership and organizational behavior are formally communicated in graduate EM curricula and offers a rigorous foundation for future studies that incorporate syllabus-level analysis, stakeholder perspectives, or longitudinal outcomes.

5. Results

This section presents the results of the curriculum analysis examining how leadership and organizational behavior are framed within graduate EM curricula. Findings are organized around the study's research questions and are reported descriptively to highlight patterns observed across program-level and course-level curriculum artifacts.

5.1 Program-Level Framing of Leadership and Organizational Behavior (RQ1)

Analysis of program-level descriptions revealed substantial consistency in how graduate programs articulate their overarching purpose and professional orientation. Across the programs examined, leadership and organizational behavior are framed within engineering and technical contexts, emphasizing preparation for leadership roles in technologically complex organizations. Table 1 summarizes program-level framing by identifying leadership perspective, organizational behavior perspective, and whether leadership is articulated explicitly or implicitly in program descriptions.

Program descriptions frequently highlighted the integration of technical expertise with managerial capability. Leadership development is commonly referenced alongside project management, decision-making, organizational effectiveness, and technical work coordination. In this framing, leadership is positioned as an extension of engineering practice rather than as a transition into general management roles.

Organizational behavior at the program level is similarly situated within engineering environments rather than abstract organizational settings. References to teamwork, organizational complexity, and socio-technical considerations are common, suggesting an emphasis on leadership in contexts where technical and organizational factors intersect. As reflected in Table 1, program-level materials convey a coherent professional identity centered on engineering leadership, although this leadership is often articulated in broad integrative terms rather than through narrowly defined competencies. The accompanying coding key defines these perspectives as follows:

- *Engineering-centered*: Leadership framed primarily within engineering systems, technical decision-making, or engineering accountability.
- *Managerial-centered*: Leadership framed primarily in general organizational or business management terms.
- *Hybrid*: Explicit integration of engineering and organizational perspectives.
- *Explicit*: Leadership directly referenced in program description.

- *Implicit*: Leadership themes embedded within engineering or systems language without direct labeling.

Table 1. Program-Level Leadership and Organizational Behavior Framing

Institution	Degree	Leadership Perspective	Organizational Behavior Perspective
Drexel University [22]	MS in Engineering Management	Managerial-centered (Explicit)	Hybrid
Missouri University of Science & Technology [23]	MS in Engineering Management	Engineering-centered (Implicit)	Engineering-centered
Rice University [24]	M.Eng. in Engineering Management and Leadership (MEML)	Engineering-centered (Explicit)	Engineering-centered
St. Cloud State University [25]	Master's in Engineering Management (MEM)	Engineering-centered (Explicit)	Engineering-centered
St. Cloud State University [26]	Executive Master's in Engineering Management (EMEM)	Managerial/Executive-centered (Explicit)	Managerial-centered
University of Nebraska–Lincoln [27]	Master of Engineering Management (MEM)	Hybrid	Hybrid
University of Texas at Austin [28]	Master's in Engineering Management (Executive Program)	Hybrid (Executive-oriented)	Hybrid

Using this framework, three of the seven programs (Missouri University of Science and Technology, Rice University, and St. Cloud State University MEM) exhibit primarily engineering-centered leadership orientation. In these cases, leadership is described as technical authority, systems coordination, or responsibility within engineering organizations. Organizational behavior is similarly framed within engineering work, often emphasizing socio-technical systems, technical teams, and engineering decision environments.

Three programs (Drexel University, University of Nebraska–Lincoln, and the University of Texas at Austin) demonstrate hybrid positioning at the program level, although the form of integration varies across institutions. Drexel emphasizes leadership and management preparation for technical professionals, reflecting stronger managerial language within a technical workforce context. The University of Nebraska–Lincoln presents a more balanced integration of engineering and organizational leadership themes. The University of Texas at Austin combines engineering identity with executive-level managerial responsibility and broader enterprise leadership. Across these cases, leadership is framed through some combination of engineering practice and organizational capability rather than through a singular engineering-only or management-only orientation.

Two programs, St. Cloud State University EMEM and the University of Texas at Austin, include executive-oriented tracks that broaden leadership articulation to encompass enterprise responsibility and organizational strategy. Even in these cases, leadership remains situated within engineering-centered contexts rather than presented as industry-neutral management preparation.

Additionally, two programs in the sample, the University of Nebraska–Lincoln and the University of Texas at Austin, permit selected MBA or business-school coursework to count toward the EM degree requirements. This structural flexibility reflects institutional integration between engineering and business units. However, even where such permeability exists, program descriptions continue to situate leadership preparation within engineering-centered professional contexts rather than presenting the degree as a generalized management credential. Hybrid positioning, therefore, is expressed not only through curricular language but also through aspects of institutional design.

Across most EM programs, leadership is articulated explicitly in program descriptions, suggesting that leadership development is a declared component of EM education rather than an assumed byproduct of technical management training. No program frames leadership in purely generic business terms, detached from engineering systems. These patterns indicate that, at the program level, EM curricula consistently anchor leadership within engineering-centered or hybrid socio-technical frameworks. Although the degree of managerial integration varies, the engineering context remains the dominant reference point across the sample.

5.2 Course-Level Articulation of Leadership and Organizational Behavior (RQ2)

Table 2 presents representative catalog language from required courses in the sampled graduate EM programs that address leadership and organizational behavior. Whereas program-level descriptions signal institutional positioning at a broad level, required course descriptions offer a more granular view of how leadership competencies are formally articulated within core curricula. To enhance transparency, representative excerpts are drawn directly from publicly available catalog descriptions and are presented verbatim or minimally truncated for clarity.

Across institutions, leadership is consistently addressed in required curricula. However, the manner of articulation varies in terms of emphasis, scope, and degree of technical grounding. In several programs, leadership is framed explicitly within engineering practice contexts. Rice University's required coursework emphasizes progression from an engineering manager to executive leadership. It also incorporates "ethical-technical leadership" language, reinforcing a conception of leadership grounded in technical authority and innovation environments. Similarly, St. Cloud State University's MEM curriculum emphasizes leadership development for high-performance engineering teams, situating leadership within project execution and technical collaboration.

Other programs embed leadership within broader narratives of engineering management rather than presenting it as a standalone construct. Missouri University of Science and Technology's core management course frames leadership as part of the engineer-to-manager transition, integrating organizational systems and behavioral concepts within an engineering management context. The University of Nebraska–Lincoln's required coursework highlights socioemotional and socio-technical considerations in team environments, reflecting integration of organizational behavior concepts with engineering strategy and decision-making.

Table 2. Required Course-Level Articulation of Leadership and Organizational Behavior

Institution	Required Course(s)	Course Nomenclature(s)	Representative Catalog Language (Excerpted)	Primary Emphasis
Drexel University [22]	Required leadership & organizational behavior course	[a] EGMT 501: Leading & Managing Technical Workers [b] EGMT 581: Human Relations & Organization Behavior	[a] "Managing and motivating technical personnel." [b] "Group dynamics… psychological and sociological factors."	Explicit organizational & technical leadership
Missouri University of Science & Technology [23]	Core management course	EMGT 511: Management for Engineers and Scientists	"Transition of engineer to manager… organizational systems and behavior… leadership."	Leadership embedded within the engineering management transition
Rice University [24]	Multiple required leadership-themed core courses	[a] RCEL 501: Engineering Management & Leadership Theory [b] RCEL 504: Ethical-Technical Leadership	[a] "Framework for engineering professionals to progress from manager to executive." [b] "Ethical-technical leadership."	Technical leadership authority & innovation context
St. Cloud State University [25]	Required engineering management course	EM663: Engineering Management	"Developing high-performance teams… motivation and leadership as applied to engineers."	Team-based technical leadership development
St. Cloud State University [26]	Required executive leadership and organizational behavior courses	[a] EM653: Engineering Ethics and Leadership [b] EM665: Organizational Behavior	[a] "Leading virtual teams… emotional intelligence…" [b] "Organizational behavior in engineering organizations."	Executive-level leadership & organizational systems
University of Nebraska–Lincoln [27]	Core team & strategy courses	[a] EMGT 805: Teamwork for Organizational Commitment [b] EMGT 905: Strategic Management	[a] "Socioemotional and socio-technical considerations." [b] "Strategic vision."	Socio-technical team leadership integration
University of Texas at Austin [28]	Required leadership & people management	ENM 380: Managing People & Organizations	"Frameworks from social sciences… effective leaders work with others."	Managerial leadership with engineering application

Executive-oriented tracks demonstrate broader managerial framing while maintaining clear engineering context. St. Cloud State University's EMEM program includes required coursework in organizational behavior and leadership that references emotional intelligence, virtual teams, and executive-level responsibility within engineering organizations. The University of Texas at Austin's executive program similarly draws on social science frameworks for managing people and organizations, emphasizing managerial effectiveness within technically complex enterprises rather than in generic business settings.

Collectively, the course-level findings indicate that leadership and organizational behavior are universally present in required EM curricula, but their articulation reflects meaningful variation in orientation. Some programs foreground technical leadership authority and engineering-centered accountability. Others emphasize the coordination of socio-technical teams and organizational integration. Executive tracks incorporate more explicit language on managerial and strategic development. Despite these differences, required coursework generally reinforces the engineering-contextualized leadership orientation observed at the program level, suggesting coherence between institutional positioning and the instructional emphasis.

5.3 Program-Course Integration Patterns (RQ3)

Comparison of program-level descriptions (Table 1) and required course articulations (Table 2) reveals substantial alignment between institutional positioning and required curricula across the sampled graduate EM programs. Programs that frame leadership primarily within engineering-centered contexts generally reinforce that orientation through required coursework. Likewise, programs that adopt hybrid or executive-oriented positioning reflect those emphases in the design and articulation of required leadership and organizational behavior courses.

In engineering-centered programs, leadership is consistently associated with technical decision-making authority, systems coordination, and accountability within engineering environments. Required course descriptions situate leadership within project execution, team-based engineering work, and management of technical personnel. Organizational behavior concepts are therefore presented as integrated components of engineering practice rather than as stand-alone managerial domains.

Programs characterized by hybrid positioning demonstrate more explicit integration of managerial and engineering language at both levels of analysis. Leadership in these cases is framed not only as technical accountability but also as coordination of organizational processes, strategic direction, and human systems within engineering enterprises. Executive-oriented tracks extend this framing further by incorporating references to emotional intelligence, organizational culture, and enterprise-level responsibility while retaining an explicit connection to the engineering context.

Notably, no program in the sample exhibited a pronounced divergence between program-level articulation and required course framing. Rather than revealing misalignment, the findings suggest coherence between declared curricular intent and the required instructional emphasis. Program descriptions signal a particular leadership orientation, and required coursework generally operationalizes that orientation in consistent ways.

These integration patterns clarify how EM programs construct leadership as contextually embedded within engineering systems. Variation across programs appears less about the presence or absence of leadership than about the degree and manner in which engineering and managerial perspectives are integrated. In this respect, EM curricula consistently position leadership within professional engineering practice, even when incorporating broader organizational and executive development themes.

6. Discussion

6.1 Engineering-Centered Leadership Identity

The findings indicate that graduate Engineering Management (EM) programs consistently situate leadership within engineering practice rather than presenting it as a generalized managerial construct. At both the program and course levels, leadership is framed as an extension of technical responsibility, encompassing systems coordination, decision authority, project execution, and accountability within engineering enterprises. This positioning reinforces the view that EM education integrates leadership development with engineering identity rather than detaching it from technical expertise.

These patterns are consistent with scholarship conceptualizing engineering leadership as socio-technical in nature and grounded in technical credibility [12-15]. EM curricula do not reframe engineers as generic managers; rather, they expand the scope of engineering responsibility to include coordination of people, processes, and organizational systems. Leadership is articulated as a professional competency that builds upon engineering judgment, risk analysis, and systems thinking, rather than replacing technical grounding with managerial abstraction.

The alignment observed between program-level descriptions and required coursework further suggests intentional curricular positioning. Leadership development appears structurally embedded in EM education rather than treated as an auxiliary skill layered on top of technical management training.

6.2 Socio-Technical Integration Across EM Curricula

A second interpretive pattern concerns the incorporation of organizational behavior within engineering contexts. Across the sampled programs, concepts such as team dynamics, motivation, strategy, and organizational systems are rarely presented as stand-alone managerial domains. Instead, they are contextualized within engineering environments and linked to project execution, socio-technical coordination, or enterprise-level technical decision-making.

This integration reflects the inherently socio-technical character of engineering practice [19]. Contemporary engineering requires coordination across technical systems, human teams, and organizational processes. EM programs appear to acknowledge this complexity by embedding leadership and organizational behavior within engineering contexts rather than treating them as external managerial overlays.

Variation across programs is therefore less about the inclusion of organizational behavior and more about the degree of explicit integration. Engineering-centered programs emphasize leadership within technical execution and systems accountability. Hybrid and executive tracks incorporate broader organizational constructs, including culture, emotional intelligence, and strategic leadership, while maintaining explicit reference to engineering enterprises. Across models, socio-technical integration remains a consistent organizing principle.

6.3 Executive Differentiation and Career Stage Alignment

The distinction between traditional and executive EM tracks introduces an additional dimension of variation associated with participant career stage and prior professional experience. Executive-oriented programs employ broader managerial vocabulary and place greater emphasis on enterprise-level responsibility,

organizational culture, and strategic oversight. This expanded framing likely reflects the needs of more experienced professionals rather than a departure from engineering identity.

Even executive tracks remain anchored in engineering organizations and technology-driven enterprises. Leadership is framed as enterprise stewardship within technically complex contexts rather than as generalized business administration. This suggests that EM education adapts leadership articulation to career stage while preserving disciplinary coherence.

The presence of executive differentiation also highlights the flexibility of EM curricula. Programs appear responsive to professional trajectories by offering leadership development pathways that range from project coordination and team leadership to enterprise governance and strategic responsibility. In this sense, executive pathways may be understood not as separate models of EM education, but as extensions of leadership development calibrated to experience level and organizational scope.

6.4 Strategic Implications for EM Education

The findings have practical implications for how graduate EM programs communicate their distinct value within an increasingly competitive professional education landscape. Leadership and organizational behavior are not unique to EM curricula. Comparable themes are also present across Master of Business Administration (MBA) and related management programs. However, MBA education is highly heterogeneous in structure, specialization, and institutional mission [5,7,8]. The present findings suggest that EM programs differentiate not merely by including leadership content, but by consistently anchoring leadership within engineering systems, technical enterprises, and socio-technical responsibility.

Across the programs examined, leadership is rarely framed as industry-neutral managerial influence detached from technical practice. Even when programs incorporate organizational behavior, strategic management, or executive development themes, these elements are typically contextualized within engineering-intensive environments. This pattern reinforces the interpretation that EM education constructs leadership identity differently from that of generalized management programs by integrating organizational capability, technical credibility, and systems accountability.

The results also suggest that clear alignment between program-level positioning and required-course articulation may strengthen the signaling of professional identity. When leadership is framed consistently across curricular layers, prospective students, employers, and other stakeholders may better understand the distinctive orientation of EM education. Such clarity may be especially valuable when students compare EM pathways with MBA or other management-oriented alternatives. At the same time, the variation observed across programs indicates that EM curricula can accommodate multiple legitimate models of leadership preparation, including engineering-centered, hybrid, and executive-integrated approaches. These alternative configurations likely reflect differences in institutional mission, student career stage, industry partnerships, and target market. Diversity in positioning, therefore, need not indicate fragmentation. Rather, it may represent adaptive flexibility within a coherent professional field.

For EM educators and professional bodies such as ASEM, these findings support more deliberate reflection on how public-facing curricular language communicates the integration of technical and organizational competencies. As Engineering Management programs continue to evolve in response to technological complexity, workforce mobility, and changing leadership demands, making leadership positioning more explicit may strengthen disciplinary coherence while preserving strategic differentiation.

6.5 Limitations

Several limitations should be considered when interpreting these findings. First, the analysis relies on publicly available program descriptions and course catalog materials rather than complete syllabi, classroom observations, or direct assessment of student learning outcomes. The findings, therefore, reflect declared curricular framing rather than enacted pedagogy. While this approach is appropriate for examining how programs communicate leadership and organizational behavior to prospective students and external audiences, it cannot capture the full nuance of instructional implementation.

Second, the sample was intentionally limited to a purposive subset of ASEM-certified graduate programs to achieve analytic coherence. Although this focus strengthens internal consistency, it does not represent the full diversity of Engineering Management programs, particularly those outside ASEM certification or situated in alternative institutional contexts.

Finally, this study does not evaluate program effectiveness or compare graduate outcomes. The analysis is descriptive and interpretive, examining how leadership and organizational behavior are articulated within curricular structures. Future research incorporating syllabus-level materials, faculty perspectives, student experiences, or employer feedback would provide deeper insight into how declared framing translates into professional practice.

7. Conclusion

This study examined how graduate EM programs articulate leadership and organizational behavior within publicly available program descriptions and required coursework. Analysis of ASEM-certified programs indicates that leadership in EM education is consistently situated within engineering-centered socio-technical contexts. Although programs vary in the degree and manner in which managerial perspectives are integrated, leadership is rarely framed as a generalized organizational construct detached from technical practice. At the program level, institutions signal professional identity through deliberate positioning of leadership as technical authority, systems coordination, and integrated engineering and managerial responsibility. Required coursework reinforces these orientations, demonstrating coherence between declared curricular intent and formal instructional structure. Executive-oriented tracks extend organizational framing to encompass enterprise-level responsibility and strategic oversight while maintaining explicit anchoring in engineering environments.

Collectively, these findings clarify how EM curricula signal leadership identity. Rather than converging toward generic management education models, the programs examined here contextualize leadership development within engineering practice and socio-technical accountability. This study contributes descriptive insight into how EM programs signal disciplinary positioning and professional preparation through curricular language. Because the analysis relies on publicly available artifacts, the conclusions reflect declared framing rather than enacted pedagogy or assessed learning outcomes. Future research incorporating syllabus-level materials, faculty perspectives, and graduate trajectories would deepen understanding of how leadership articulation within EM education translates into professional development and long-term practice.

By examining leadership representation across program and course levels, this study offers a structured framework for understanding the curricular identity of graduate EM education. It establishes a foundation for continued inquiry into its evolving professional role.

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