

THE GEORGE WASHINGTON UNIVERSITY
School of Engineering and Applied Science (SEAS)
SEAS Online Programs Office

**STUDENT GUIDELINES:
DOCTOR OF ENGINEERING DEGREE
IN ENGINEERING MANAGEMENT**

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DOCTOR OF ENGINEERING DEGREE IN ENGINEERING MANAGEMENT**

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Doctor of Engineering Program Overview

The online Doctor of Engineering program in engineering management [D.Eng.(EM)] consists of a minimum of 45 credit hours divided into 2 stages. The first stage comprises a classroom experience of 10 graduate-level, 3-credit-hour courses culminating in the student's submission—and the faculty's acceptance—of the praxis proposal. The second stage comprises an independent research effort of at least 15 credit hours of praxis research culminating in the praxis defense. These stages must be completed by specific deadlines in keeping with the accelerated nature of the program. After completing the classroom courses, the student develops and defends an original praxis in the field of engineering management. Students can expect to complete all requirements within 2 years. If sufficient progress is made, an extension may be permitted.

The objectives of the Doctor of Engineering program in engineering management are to ensure that graduates:

- Explain and apply the process of engineering management research to solve a real-world problem using current engineering management concepts and tools.
- Produce a praxis for use by practicing engineers to address a common concern or challenge.
- Articulate their expertise and knowledge so as to apply it directly in a business or technical environment.

1. Registration

The student must maintain continuous enrollment throughout the doctoral program. Semester enrollment information is distributed by the SEAS Online Office by email before the start of each semester, and registration is processed directly by the office on the date listed in that email, on the condition that the student has fulfilled academic and financial obligations to the university.

Registration holds are placed on the accounts of students with outstanding balances. Our office cannot process registration when there is a registration hold on the account. For this reason, students must make payments on time each semester. Late payment of tuition is possible grounds for removal from the doctoral cohort. Find withdrawal and tuition refund policies at <https://seasonline.gwu.edu/about-us/policies-procedures-doctoral/>.

2. The Classroom Stage

2.1 Leaves of Absence/Transfer of credit

Leaves of Absence. Students enter the program as members of a cohort (group), are registered as a cohort, and take their courses in lockstep in successive semesters until completion of the program. The D.Eng.(EM) curriculum is determined by the faculty, and course information is provided to students by email from the SEAS Online office before the start of each semester. A D.Eng. student who finds it necessary to interrupt active pursuit of the degree may petition the office for a leave of absence by emailing a full explanation and attaching a completed LOA form and any supporting documentation to seasdoc@gwu.edu. Petitions are usually answered within two workweeks. Leaves of absence may be granted for family emergency (up to 6 months), physical or mental health treatment (up to 6 months), or deployment to active military duty (up to one year).

Transfer credit: Transfer of credit is not permitted in doctoral programs.

2.2 Grading and Scholarship

To complete the classroom stage of the D.Eng.(EM), students must satisfactorily complete the required curriculum of 30 credit hours, complete each course with a grade of **B-** or better, and achieve a minimum final GPA of 3.2.

If a D.Eng. student receives any grade below B-, graduate study is terminated, and further enrollment is prohibited. Any student whose cumulative GPA falls below 3.2 will be automatically placed on probation. While on probation, a student must maintain a GPA of 3.2 or higher for the 2 courses completed in any session or their enrollment will be terminated. Probation will be lifted once the student's cumulative GPA exceeds 3.2.

GW uses the following grading system for graduate students: **A, B, C, F**; other grades that may be assigned are **A-, B+, B-, C+, C-**. Individual course grades are based on a standard curve relative to the class average.

2.3 The Praxis Proposal

In the program's last classroom course, EMSE 8100: The Praxis Proposal, students propose and defend the praxis they wish to undertake during the research phase. The praxis synthesizes engineering theory and practice to create value for practical use. For an acceptable praxis, the student must think critically, combining reflection and action to put forward a specific, useful application to solve an authentic problem. The praxis should engage an existing, "real," engineering management issue and take a new approach to its resolution, applying engineering theory and practice to recommend a worthwhile solution. The praxis must use the latest engineering management concepts and tools.

With the consent of one or both of SEAS Online Programs Academic Director Professor Shahram Sarkani and Co-Director Professor Thomas A. Mazzuchi, the student may focus

the praxis on one of the sample areas of research below, or on an area outside of these:

- E-Commerce and the Entrepreneur
- Engineering Management in a Healthcare Environment
- Human Resources and Organizational Behavior
- Innovations in the Management of Technology
- Logistics Planning and Management
- Management of Large-Scale Projects
- Managing Technological Innovation
- Product and Process Improvement

The praxis proposal is submitted to one or both Academic Directors and to the EMSE 8100 instructor. It must include: 1) a clear problem description, 2) the goals of the study, 3) identification of data availability, and 4) a detailed explanation of the solution method to be used. The praxis proposal is defended in the 8100 class and must be passed before the student is admitted to candidacy for the D.Eng.(EM) to begin research and work on the praxis.

3. The Research Stage

Following successful completion of the classroom stage, the student is admitted to candidacy for the D.Eng. and is enrolled in “EMSE 8199: Praxis Research” to conduct the research to be developed into the praxis.

The 15 credit hours of EMSE 8199 taken in the research stage are used to develop and write the praxis. Students are registered for a minimum of 6 credit hours in each Fall and Spring semester and 3 credit hours in Summer. Extensions may be granted case by case if the student is making acceptable progress.

Students are required to submit the first two chapters of the praxis (Introduction and Literature Review) by the end of the first semester of research and receive approval from the advisor. Students who fail to do so will meet with the program directors to discuss the path forward.

The average minimum amount of out-of-class or independent learning you should expect to perform each semester in the research course is about 20 hours per week.

3.1 Praxis Research Advisors

The program faculty assign doctoral research advisors to the D.Eng. candidates as they enter the research phase. Students work with their assigned advisor for the remainder of the program.

3.2 Research Advising Meetings and Feedback

Each session’s advising meeting dates are communicated to the cohort by the research

advisor.

Advisor directly manages the research course EMSE 8199 through Blackboard. Deadlines for submitting slides for the research meetings are set by the advisor and communicated to the students through Blackboard or by email.

Advisees are required to attend the research meetings. Candidates are responsible for submitting slides covering research progress to the advisor by the deadline provided in the meeting announcement. Slides must be submitted for all meetings, even if the student will be absent.

Students receive written feedback from the advisor after each advising meeting. Progress is noted as:

- **Green**—Student is making sufficient progress toward stage 2 completion
- **Yellow**—Student is making some progress, but is in danger of not meeting program timeline
- **Red**—Student is making insufficient progress

If the advisor determines that the student makes insufficient progress in a semester, an NC ('No Credit') grade is assigned for EMSE 8199 on the transcript and the candidate's program and research toward the D.Eng. is terminated. A one-time courtesy option to convert in the current semester to a post-master's professional degree (Engineer or Applied Scientist) is offered.

3.3 Research Submissions

All versions of the praxis paper must be forwarded to the program advisor for review and approval. All final advisor-approved praxes must be sent to seasonline@gwu.edu for academic integrity review prior to submission. See "3.5 A Note on Academic Integrity" below.

3.4 The Praxis Defense

Upon successful completion of all prior requirements, the candidate must submit the final praxis, approved by the advisor, to seasdoc@gwu.edu with a request for AIR evaluation. An email confirmation is sent once the item has passed and is approved for submission. Below are guidelines and instructions for the praxis defense (final examination):

- See the Appendix to this document, "Researching and Writing the Praxis Paper."
- Refer to <https://library.gwu.edu/seas-etsd> for praxis format guidelines.
- The praxis paper proper (the body of the paper) should be approximately 80 pages. When including all front and back matter -- contents, lists, references, appendixes -- the praxis paper should not exceed 150 pages.
- Once the advisor approves the final version of the praxis, you forward it to seasdoc@gwu.edu requesting an Academic Integrity Review (AIR).

- Upon receiving your final praxis from you, the office submits it for AIR. If it does not pass, we notify you asking that any problems be fixed.
- When the praxis meets AIR requirements, the final examination is scheduled and details are announced by email. At that time, all graduation paperwork and committee information are provided.
- Membership on the committee of examiners consists of at least 3 faculty members. Effective Fall 2018, no outside advisor will be required.
- The student submits the praxis to the committee by email or hard copy depending on the preference of the committee member.
- The defense presentation should include a restatement of the problem under study, a description of the data used or dataset created, a description of the assumptions used in the analysis, and a discussion of the results and how they will be used.
- When the final examination committee is convinced of the quality and originality of the candidate's contribution to knowledge as well as his or her mastery of the scholarship and research techniques in the field, the committee recommends the candidate for the degree of Doctor of Engineering.
- Praxis submission deadlines (no later than the dates shown) for the final paper to be ready for defense, after AIR approval, in order to defend and graduate in the semester listed are:

Semester	Deadline
Spring	April 1
Summer	July 15
Fall	November 15

- After a successful praxis defense, students must submit the advisor-approved final version to GW's ETD system. Before submitting, the praxis must properly formatted, following the GW ETD Formatting and Submission guidelines.

3.5 A Note on Academic Integrity

All papers are expected to use proper citation and pass the AIR without issue. If a paper fails the AIR, the SEAS Online Programs Office provides a courtesy report to the student so that appropriate updates can be made. Submissions with academic integrity concerns that do not pass the review on the 3rd attempt may be forwarded to the GW Academic Integrity Council for additional evaluation. The GW Code of Academic Integrity may be viewed at <http://www.gwu.edu/~ntegrity/>.

In researching the praxis, and in any published and public results, the candidate must follow GW policies on research conduct and the use of copyrighted material. See <http://my.gwu.edu/files/policies/ResearchMisconductPolicy.pdf> and <http://library.gwu.edu/etd/copyright>.

4. Graduation Clearance and Diplomas

After a successful praxis defense the SEAS Online Programs Office assembles all necessary documents for graduation clearance.

Degrees are conferred in January, May, and August. To be recommended by the faculty for graduation, a student must have met the admission requirements of the school in which registered; completed satisfactorily the scholarship, curriculum, and other requirements for the degree; filed an application for graduation by the date requested; and be free from all indebtedness to the university. Enrollment is required in the semester at the close of which the degree is to be conferred, and all degree requirements must be completed by the last day of final examinations for that semester.

Diplomas are mailed 12-14 weeks following the date of degree conferral, barring unforeseen circumstances. Diplomas are mailed to the Diploma Address in the record. The candidate is responsible to enter this address in the GWeb information system and make any updates. See the following link for graduation application instructions: <https://registrar.gwu.edu/online-graduation-application-instructions>. The Diploma Address must be entered before the application for graduation is submitted.

If you do not receive the diploma by 12-14 weeks after your graduation date, check the online transcript to see if the degree was conferred. If it was conferred, the missing diploma must be reported to the Registrar's Graduation Services Office within 6 months. After that time a fee is charged for a replacement diploma. Also check to see if there are any financial holds on the account. A diploma is only sent if the balance owed is less than \$500. If the degree was not conferred, check with the Office.

5. Commencement

Participation in the annual commencement ceremonies in May is open to students who have applied to graduate in that spring semester or who graduated in the preceding fall or summer semester.

Doctoral candidates who have not successfully defended their praxes and completed their ETD approval form by April 1 may not participate in either the May commencement ceremonies or the SEAS graduation ceremony.

Students who apply to graduate after the published deadlines are not guaranteed commencement materials and may not be listed in the commencement program. Find more

information about University Commencement at <https://commencement.gwu.edu/>.

6. Administration

The SEAS Online Programs staff is responsible for monitoring and tracking student progress. For this reason, all communication related to the D.Eng.(EM) program must involve the Office (seasdoc@gwu.edu). Relevant communications comprise advisor/student interaction, research inquiries, and all other program-related information. Additionally, students are expected to keep the Office informed of their current contact information, such as email address, home address, and telephone numbers including cell phone numbers.

Find university policies and regulations in the George Washington University Bulletin at <http://www.gwu.edu/~bulletin/>.

<p>The University reserves the right to change courses, programs, fees, and the academic calendar, or to make other changes deemed necessary or desirable, giving advance notice of change when possible.</p>

APPENDIX
RESEARCHING AND WRITING THE PRAXIS PAPER
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1 Introduction

Generally speaking, a praxis is “the practical application of a theory.”[1] In academia, a praxis for the Doctor of Engineering stands between a thesis for a master’s degree and a dissertation for a research doctorate such as the Doctor of Philosophy (Ph.D.).

A master’s thesis usually addresses a subject of limited scope that has been researched by the student by consulting published source material or has been explored by limited experimentation by known techniques; there is normally no expectation of publishing the results in a professional venue. A dissertation for a research doctorate explores uncharted territory in a carefully circumscribed area of knowledge. It may involve invention of new research techniques or technology, and is by definition a contribution of new knowledge to the subject field; such work is normally reported in a professional journal, where it is available to everyone.

In contrast, the applied research for the GW School of Engineering and Applied Science Doctor of Engineering (D.Eng.) degree is written up as a praxis, in which engineering theory and practice are synthesized to create value for practical use. The praxis is a report on a practical problem in the management of engineering. It could be the description of the application of advanced engineering tools to a complex technical, environmental, or economic problem.

The D.Eng. in engineering management degree requires that a candidate write both a praxis proposal and a praxis paper. This document provides guidance for D.Eng.(EM) candidates and advisor on the preparation of the praxis.[2]

2 Doctor of Philosophy Research vs. Doctor of Engineering Research

Ph.D. research leads to foundational, basic findings that are publishable in peer-reviewed journals or books. The Ph.D. holder tends to practice engineering in the academy or in research investigation in a specific area.

The D.Eng. demands that the student’s research be applied to solve an actual problem; thus, research for the D.Eng. is applied, rather than foundational like research for the Doctor of Philosophy (Ph.D.). The aim of D.Eng. research is to develop original solutions to real-world industry problems using the latest engineering concepts and techniques—to apply the knowledge directly to problems encountered in daily life. While focusing on engineering practice, D.Eng. research in the field of engineering management also develops the practitioner’s leadership potential.

In short, the essential difference between research toward the Ph.D. and toward the D.Eng. is the “basic” nature of the former and the “applied” nature of the latter.

Basic research (Ph.D.) can be defined as “systematic study directed toward greater

knowledge or understanding of the fundamental aspects of phenomena and of observable facts *without specific applications* towards processes or products in mind”[3] (emphasis added). Directed toward increasing fundamental knowledge and understanding in the field of study, basic research is visionary and high-risk–high-reward. As such, it can lead to applied research or to development of advanced technology.

Applied research (D.Eng.) is a “systematic study to understand the means to meet a recognized and specific need. It is a *systematic expansion and application of knowledge* to develop useful materials, devices, and systems or methods.”[4] (emphasis added). Applied research transforms findings of basic research to solutions to specific, complex, real-world problems or technological challenges, establishing their feasibility and practicality.

D.Eng. research efforts lead to increased in-house knowledge for the organizations that are involved, by leading to such outcomes as business processes improvement, time-to-market acceleration, and cost saving. In the long term, they can even result in sector-wide or society-wide business and policy change. Through collaborative effort, the knowledge generated is diffused from one firm to the industry as a whole, helping to develop a pool of highly skilled professionals and leaders.

3 Outline of the D.Eng.(EM) Program

The D.Eng.(EM) program goal is to graduate professionals who are applied researchers, technology managers and advocates, and leaders in their fields. Graduates will know how to address problems that arise in the technological and engineering sectors that have a nontechnical impact on society. Courses on such topics as data analysis, knowledge management, entrepreneurship, technology marketing, and managing e-commerce technology are designed to broaden the students’ knowledge base and prepare them for industry leadership.

D.Eng. graduates have developed skills in critical thinking, in identifying problems pertaining to inefficiencies in an organization, in devising optimal solutions, and in conducting research of real use to industry. This partnership between academia and industry generates and transfers new knowledge for immediate application, guiding industry and policy. The real-world problems attacked in D.Eng. praxes involve multidisciplinary factors from engineering, business, and social sciences. This broad interdisciplinary foundation is a significant aspect of the GW D.Eng. program and a major asset for its alumni.

3.1 Program Learning Objectives

The objectives of the D.Eng.(EM) program are to ensure that graduates can:

- Explain and apply the processes of engineering management research to solve a real-world problem using current engineering management concepts

- and tools.
- Produce a praxis or case study for use by practicing engineers to address a common concern or challenge.
 - Articulate their expertise and knowledge to apply it directly in a business or technical environment.

3.2 Two Research Documents and Two Oral Exams

A praxis proposal and a praxis paper must be successfully defended—separately and orally—before committees of the faculty. Upon completing the D.Eng.(EM) program classroom phase with a GPA of no less than 3.2, and successfully defending the praxis proposal, students undertake directed study to research, write and defend the praxis. Successful defense of the praxis is the final requirement for award of the degree.

- A. *Praxis Proposal*: Defines the student’s research, which is an analysis of a real-world problem on a topic related to engineering management, chosen by the student, and approved by the adviser. It is orally defended before a faculty committee.
- B. *Praxis*: Research is guided by two advisers. It is orally defended before a committee of at least three faculty members determined by the SEAS Online Programs office.

3.3 Assessment

Before a defense, Turnitin originality checking services are applied to the final versions of praxis proposals and praxes. Defenses of the D.Eng. qualifying examination (praxis proposal), and the final praxis follow the pattern long used at GW-SEAS for Ph.D./D.Sc. dissertations.

4 The Engineering Management Field of Study

The fundamental objective of the field of engineering management is to apply engineering principles and techniques to managerial and business problems that arise in the technology/commercial sector. Deep knowledge of both engineering and management are required for the application of engineering management techniques to succeed. A multidisciplinary area, engineering management involves aspects of engineering, systems thinking, mathematical modeling, and human factors, and encompasses such disciplines as management of technology, operations research, systems engineering, management science, industrial engineering, financial management, quality control, and project management.

4.1 Research Topics that are Acceptable for the Praxis

The American Society of Mechanical Engineers identifies eight domains of engineering management knowledge [5], any of which is suitable for a praxis, defined briefly as follows:

a. **Market Research, Assessment and Forecasting**

Processes and activities involving market research: market analysis, benchmarking practices, business forecasting, risk analysis, trend analysis.

b. **Strategic Planning and Change Management**

Steps involved in bringing a new product or technology to market; includes technology planning, knowledge management, lifecycle engineering, strategic management, financial risk management.

c. **Product, Service and Process Development**

Identifying the engineering disciplines necessary for development of a product and its manufacturability and design methodology; can include feasibility analysis, lean production techniques, total quality management, Six Sigma.

d. **Engineering Projects and Process Management**

Financial and project management aspects of production; includes project management, scheduling, budgeting, supply chain and demand constraints, customer satisfaction, cycle time analysis.

e. **Financial Resource Management**

Procurement and contract procedures, funding sources, economic analysis, budget and resource planning, inventory, and supply chain management.

f. **Marketing, Sales and Communications Management**

Marketing practices; involves product portfolio analysis, global trade, international operations, pricing strategies.

g. **Leadership and Organizational Management**

Management styles and organizational structures most conducive to managing professionals; such topics as leadership, human resource management, organization structure.

h. **Professional Responsibility, Ethics and Legal Issues**

Understanding and applying regulatory requirements, codes of ethics, standards. Intellectual property considerations.

A chart of engineering management domains of knowledge and their subdomains appears

in Fig. 1 in Section 9 Appendix.

4.2 Research Methods that are Acceptable for the Praxis

Engineering management involves a diverse range of topics, problems, and questions, and D.Eng. research may use a variety of research methodologies, some of which are listed in Fig. 2 in Section 8 Appendix.

5 The Praxis Proposal (A Review)

By the end of the classroom course phase of the D.Eng. program, the student has been introduced to the design of research studies in applied engineering management settings from a practical perspective, has explored the fundamentals of applied research, and has learned to formulate appropriate research questions and hypotheses, and to design a research study from empirical data. Successful defense of the praxis proposal means that the student knows how to:

- 1) Define, summarize, and outline a problem description clearly
- 2) Select appropriate goals for an extended study
- 3) Identify the data needed for an extended study and where it is to be found
- 4) Explain in detail the solution method to be used
- 5) Organize, present, and defend a strong proposal before a group of decision makers

6 The Praxis

Research for the D.Eng.(EM) praxis is independent applied research in engineering management guided by a faculty advisor. Upon completing the praxis, students will have achieved the program learning goals (see Section 3.1 above).

The D.Eng.(EM) program is largely distinguished by the nature of its research phase. Since the praxis is, by definition, a report on the practical resolution of an actual, real-world problem in engineering, it may be either a description of the problem and how existing tools or techniques can fruitfully be applied to its resolution, or a study of the application of advanced management tools or technologies in the resolution of an actual problem. To date, nearly all the praxes prepared for the D. Eng.(EM) program at GW have been of the former kind.

The praxis describes the phases of the research and reports the research findings in chapters that normally include Introduction; Literature review; Methodology; Results; and

Conclusions. These are briefly described below.

6.1 Introduction Chapter

The introduction provides a brief background about the problem that justifies the study. It discusses the significance of the problem, and it must include:

- problem statement (purpose and significance of the study),
- thesis statement (claim of the researcher and potential solution to the problem),
- research questions (suggesting the relationship among variables that should be empirically testable),
- the research objective (statement of the research direction and specific actions), and
- hypotheses (declarative statements about expected or predicted outcomes).

6.2 Literature Review Chapter

Whereas a Ph.D. dissertation is expected to include a comprehensive review of related literature and a summary of all the research that has ever been published on that subject, the D.Eng. praxis literature search need only review those writings that support the limited practical application of the technology or case study. All available resources, such as books, journal papers, and websites, can be used. The literature review critically analyzes the existing technical body of knowledge related to the problem under study. This critique should demonstrate that the author has a grasp of the major ideas and findings pertaining to his or her topic. The literature review includes an overview of the subject; categorization of the work under review based on such factors as opposing theories and methodologies; an explanation of the similarities and differences of the publications cited; and a critical analysis and evaluation of the works reviewed, including discussion of their strengths and weaknesses.

While, as stated above, a D. Eng. literature review focuses on application of theory and is not necessarily comprehensive, nevertheless, D.Eng. candidates must establish that they have a deep understanding of the topic and awareness of the newest methods and approaches for solving the problem. Peer-reviewed articles published in high-impact journals are highly desirable references for this purpose. The most prestigious journals in engineering management at the time of this writing include:

- *Engineering Management International*
- *Engineering Management Journal*
- *Engineering Management Research*
- *IEEE Transactions on Engineering Management*
- *Journal of Engineering and Technology Management*

- *Journal of Management in Engineering*

6.3 Methodology Chapter

This chapter contains a detailed overview of how the research was conducted and walks readers through the procedures and steps. The research methodology (or method) is the process of starting from raw data and ending up accepting or rejecting the research hypotheses. See Fig. 2.

6.4 Results, Discussion, and Conclusions Chapters

The results chapter should present the output, in the form of figures and tables, from applying the research methodology to raw input data. No discussion or interpretation should be included in the results chapter. The discussion describes the research results as related to the research questions and hypotheses and refers to the literature review for comparison. The conclusions summarize the overall point(s) that the researcher wants the reader to remember.

6.5 Examples of Contributions of Recently Defended Praxes

- One praxis created “a smart home energy management system using a limited memory algorithm for bound constrained problems, along with time-of-use pricing to optimize appliance scheduling in a 24-hour period. The allocation of energy resources for each appliance is coordinated by a smart controllable load device embedded in the household’s smart meter. Simulation results confirmed that the proposed algorithm effectively improved the operational efficiency of the distribution system, reduced power congestion at key times, and decreased electricity costs for prosumers.”
- Another modeled “The human brain ... using the cognitive cycle, a continuous loop of detection, interpretation, and action which guides decision-making and performance. In human-driven queues, these elements can affect queuing performance. The research develops a generic system dynamics queuing model. Via simulation, this research demonstrates the application of the generic model to passport inspection stations at John F. Kennedy International Airport, [which] systematically develops a matrix of improvement strategies.”
- A third “establishes a technical uncertainty framework and quantification methodology to reduce system failures and increase reliability within a metropolitan railway system using disruption data from the Washington Metropolitan Transit Authority.”

6.6 Selected Praxis Titles

- A. “A Technology Maturity Assessment of Sustainment Dominated Systems under the Influence of Obsolescence”
- B. “Planning for the Influence of Emerging Disruptive Technologies on IT Systems”
- C. “A Generalized Approach to Measure and Predict Innovation Maturity Progression Aligned to Business Objectives”
- D. “Identifying and Overcoming the Barriers to Cloud Adoption within the Government Space”
- E. “Managing Risk as a Function of the Nuclear Work Model”
- F. “Pre-Design Methodology for Establishing Scope–Budget and Scope–Duration Alignment for Capital Projects”
- G. “Cross-Domain Knowledge Management Strategy for Mission Areas within the Force Projection Sector”
- H. “Application of Multi-Criteria Decision-Making Methods to the DLA Energy Military Construction Portfolio Selection Process”
- I. “Improving Team Performance by Identifying Significant Attributes Required in a Knowledge Management Solution for Fast-Paced Research Teams”
- J. “Ranking of Cloud Service Providers Using a Dynamic TOPSIS Model for Provisioning of Enterprise IT Infrastructure in the Cloud”
- K. “Application of Engineering Principles with a Comparison of Machine Learning Classification Methods to Predict Treatment of Outcomes in Head and Neck Cancer Patients”
- L. “Quantitative Framework for Biopharmaceutical New Product Introduction”
- M. “A Risk Matrix to Equip IT Practitioners in Government Operation Centers against Cyberattacks”
- N. “A Practical Framework for Digital Service Innovation in the Public Sector: Improving North American Industry Classification System Code Usage to Enable the Convergence of Public, Private, and Multinational Participants”
- O. “Establishing Interactive Teams to Help Locate Children Missing from State Care Using Quantitative Analysis Techniques”
- P. “Reduction of Railway System Failures through Technical Uncertainty Analysis”
- Q. “Model-Based Alternative to Document-Based System Development for Enterprise Resource Planning”

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8 Notes

[1] Merriam-Webster, definition 2. <https://www.merriam-webster.com/dictionary/praxis>, accessed 28 Feb 2018.

[2] The following writing resources provide useful technical writing assistance: Praxis question (see <http://writingcenter.gmu.edu/articles/7605>); Thesis statement (see <http://writingcenter.unc.edu/handouts/thesis-statements/>); Research writing (see <https://owl.english.purdue.edu/owl/resource/658/01/>).

[3] John F. Sargent Jr., “Department of Defense Research, Development, Test, and Evaluation (RDT&E): Appropriations Structure,” Congressional Research Service, 7-5700, www.crs.gov, R44711, December 13, 2016.

[4] Sargent, 2016.

[5] ASME Book Committee, *Guide to the Engineering Management Body of Knowledge*, doi: 10.1115/1.802991, 2010

<http://ebooks.asmedigitalcollection.asme.org/book.aspx?bookid=306> accessed 1 Mar 2018.

9 Appendix: Illustrations

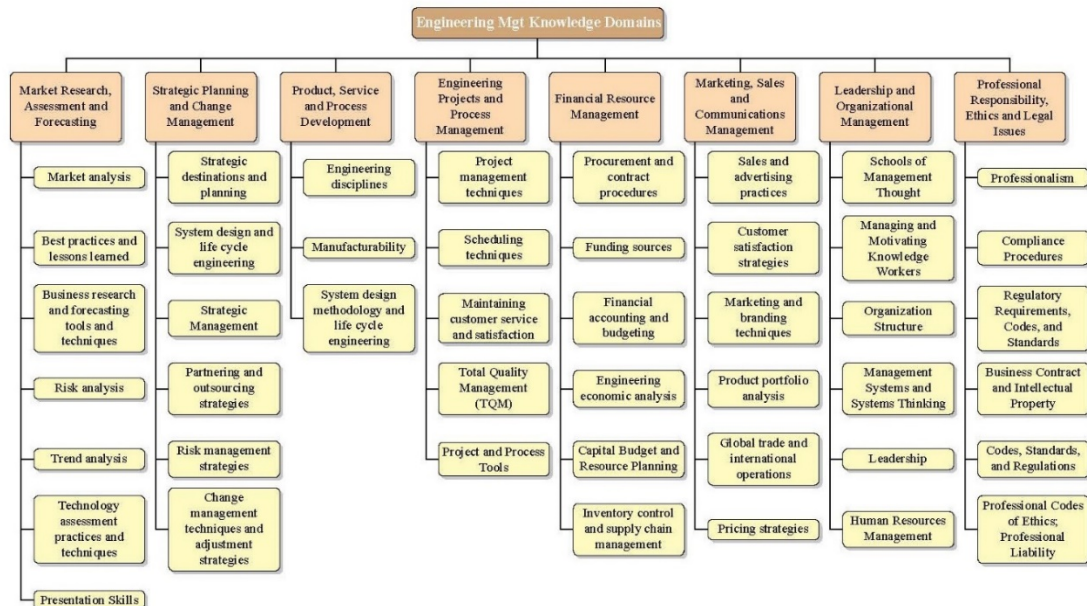


FIG. 1. ENGINEERING MANAGEMENT DOMAINS OF KNOWLEDGE.

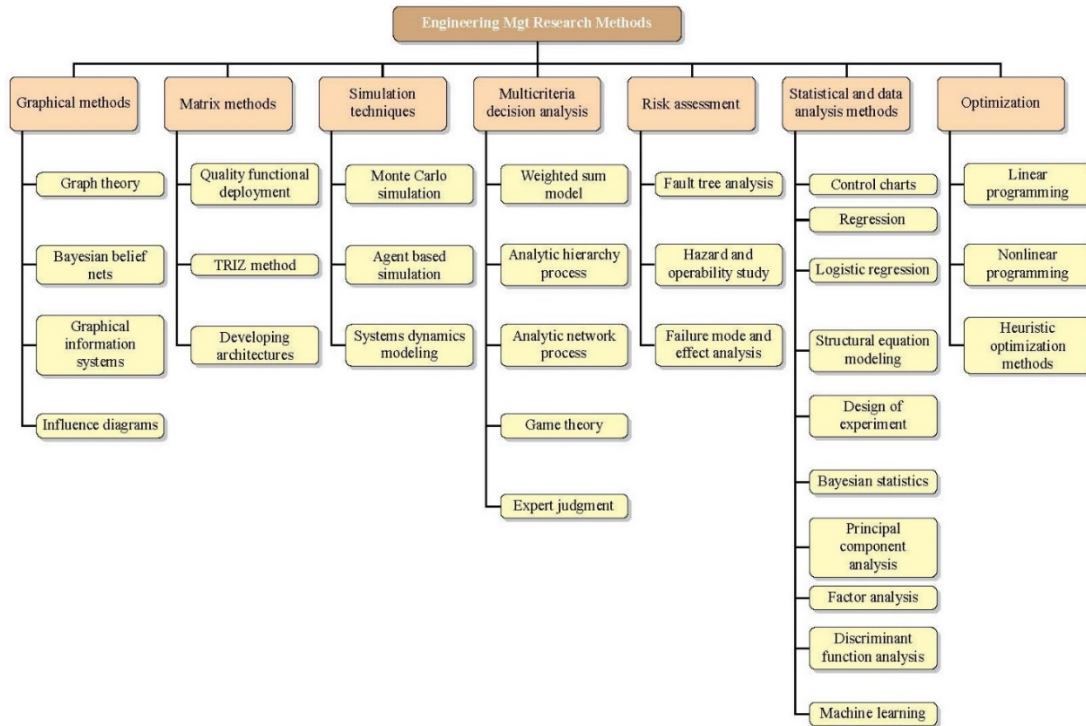


FIG. 2. RESEARCH METHODS IN ENGINEERING MANAGEMENT