FACTORS OF COMPETENCIES OF DESIRED GRADUATES FOR CAREERS IN ENGINEERING MANAGEMENT AND ENTREPRENEURSHIP PROGRAM

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A THESIS REPORT SUBMITTED IN PARTIAL FULFILLMENT
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ABSTRACT

This research aims to develop a questionnaire to gather preliminary data from students, business organizations, professors, and individuals involved with the curriculum. The research outcomes will determine factors related to the competencies in Engineering Management and Entrepreneurship. These factors are categorized into several levels, with the average importance level and measurement of importance level respectively as follows, for Engineering Management, Tier 1 - Personal Effectiveness Competencies = 27.57, 0.24; Tier 2 - Academic Competencies = 37.14, 0.29 (Maximum value of measurement of importance level); Tier 3 - Workplace Competencies = 41.68, 0.20; Tier 4 - Industry-Wide Technical Competencies = 27.93, 0.16; Tier 5 - Industry-Sector Functional Area 26.95, 0.24; and Tier 6 - Professional in Engineering Management and Training = 23.56, 0.15. for Entrepreneurship, Tier 1 - Personal Effectiveness Competencies = 23.20, 0.19 (Maximum value of measurement of importance level); Tier 2 - Academic Competencies = 23.93, 0.19 (Maximum value of measurement of importance level); Tier 3 - Workplace Competencies = 23.72, 0.16; Tier 4 - Industry-Wide Technical Competencies = 23.56, 0.14; Tier 5 - Industry-Sector Functional Area = 22.20, 0.16; and Tier 6 - Professional in Engineering

Management and Training = 23.56, 0.15. Furthermore, the main factors are further divided into various sub-factors.

Keywords: Engineering Management, Entrepreneurship, Professional Competence, Skills, Knowledge, Career

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Lalitpat Thamsuwan

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Chapter 1

Introduction

1.1 The origin and research directions

When children choose to study a new field, they need to understand what they will be learning, why they are studying it, what they can do after graduation, and whether the courses align with market needs. Institutions must strive to create relevant and effective courses, ensuring graduates possess sufficient abilities and skills for their professions.

The Engineering Management and Entrepreneurship program, introduced in 2023, aims to produce graduates for the market. The curriculum includes various components such as General Education (GenEd), Mathematics and Science, Fundamentals of Engineering, Business Management, Economics, Entrepreneurship, Project, Capstone, IT, Core Courses, Minor Module, Free Elective, and Internship Training, totaling 147 credits. While the curriculum offers diversity, ongoing development is essential to meet market demands.

This research aims to study the factors of professional competence in the Engineering Management and Entrepreneurship program. The researchers seek to gather information, identify areas for improvement, and explore necessary changes for future suitability.

1.2 Research Objective

1.2.1 Identification of key core competencies essential for success in careers in Engineering Management and Entrepreneurship.

1.2.2 Exploration of factors contributing to the development and recognition of these competencies in graduates.

1.2.3 Examination of the effectiveness of current educational methods in fostering these abilities within Engineering Management and Entrepreneurship programs.

1.2.4 Assessment of the alignment between industry needs and the competencies emphasized in Engineering Management and Entrepreneurship.

1.2.5 Suggestions for improving educational methods to better prepare students for future career success.

1.3 Research Scope

1.3.1 Analysis of the importance of knowledge and skills necessary for professions in Engineering Management and Entrepreneurship through market labor demand surveys in these fields.

1.3.2 In-depth analysis and exploration of competencies related to Engineering Management and Entrepreneurship required in the industry.

1.3.3 Study on the framework that aids in defining and analyzing the capabilities suitable for students in courses related to Engineering Management and Entrepreneurship.

1.3.4 Exploration and analysis of appropriate teaching and learning methods for developing knowledge and skills in Engineering Management and Entrepreneurship.

1.3.5 Exploration and analysis of factors influencing the preparation and production of capable students for the growing field of Engineering Management and Entrepreneurship.

1.3.6 Testing and evaluation of educational programs focused on developing the abilities and knowledge of students in Engineering Management and Entrepreneurship.

1.3.7 Prediction of trends in the development of skills and knowledge necessary for students who will pursue professions in Engineering Management and Entrepreneurship in the future.

1.4 Material

1.4.1 Skill mapping at KMITL

Skill Mapping at KMITL is an online tool providing detailed insights into the skills developed in each course. It's a dynamic resource benefiting students, educators, and industry professionals.

For students, it offers a clear view of the skills they'll gain, helping align education with career goals. Educators use it for curriculum development, ensuring courses stay relevant.

Notably, Skill Mapping bridges academia and industry, facilitating communication with employers. Regular updates keep it current, preparing students for the evolving job 3market.

In essence, Skill Mapping is a dynamic, user-friendly tool connecting academic learning with real-world skills for a well-rounded education."

1.4.2 SPSS Program

SPSS Program stands for "Statistical Package for the Social Sciences." It is a software package used for statistical analysis. SPSS provides a comprehensive set 3

of tools to perform various statistical procedures, data management, and data analysis. Researchers and analysts often use SPSS to process and analyze data in fields such as social science, psychology, marketing, health, and more. The software allows users to generate tables, charts, and plots, as well as conduct advanced statistical analyses like regression, analysis of variance (ANOVA), factor analysis, and more.

1.4.3 Paper

The collection of articles covers various topics related to education, career choices, and skills development. These include factors influencing accounting students' choice of entrepreneurship, professional profiles in engineering, factors influencing entrepreneurship education in vocational high schools, the impact of experiential entrepreneurship pedagogy on graduates' employment, entrepreneurship intentions among fresh graduates in Nigeria, the impact of digital technologies on engineering management courses, challenges faced by fast-developing countries in harmonizing economic growth, the importance of soft skills for management graduates, and a comprehensive framework of competencies for engineering managers. Each article explores specific aspects and provides insights based on research findings.

1.5 Research Steps

1.5.1 Study the research project topic and summarize the significance of this study.

1.5.2 Establish the conceptual framework for Factors of Competencies of Desired Graduates for careers in Engineering Management and Entrepreneurship.

1.5.3 Design this research as an exploratory study by creating a questionnaire based on the conceptual framework to explore Factors of Competencies of Desired Graduates for careers in Engineering Management and Entrepreneurship.

1.5.4 Develop a Conceptual Framework.

1.5.5 Conduct content validity testing of the questionnaire with experienced experts to ensure the questionnaire is accurate, comprehensive, relevant, and as precise as possible.

1.5.6 Distribute the revised questionnaire to a preliminary sample of 50 respondents and then test the validity of the data using Cronbach's Alpha.

1.5.7 Distribute the final validated questionnaire by targeting specific groups including organizations, faculty, and stakeholders who are directly involved, to ensure the responses are realistic and comprehensive.

1.5.8 Analyze the survey data from all sample groups to determine the importance level of Factors of Competencies of Desired Graduates for careers in Engineering Management and Entrepreneurship.

1.5.9 Summarize the research findings.

1.6 Planning Gantt Chart

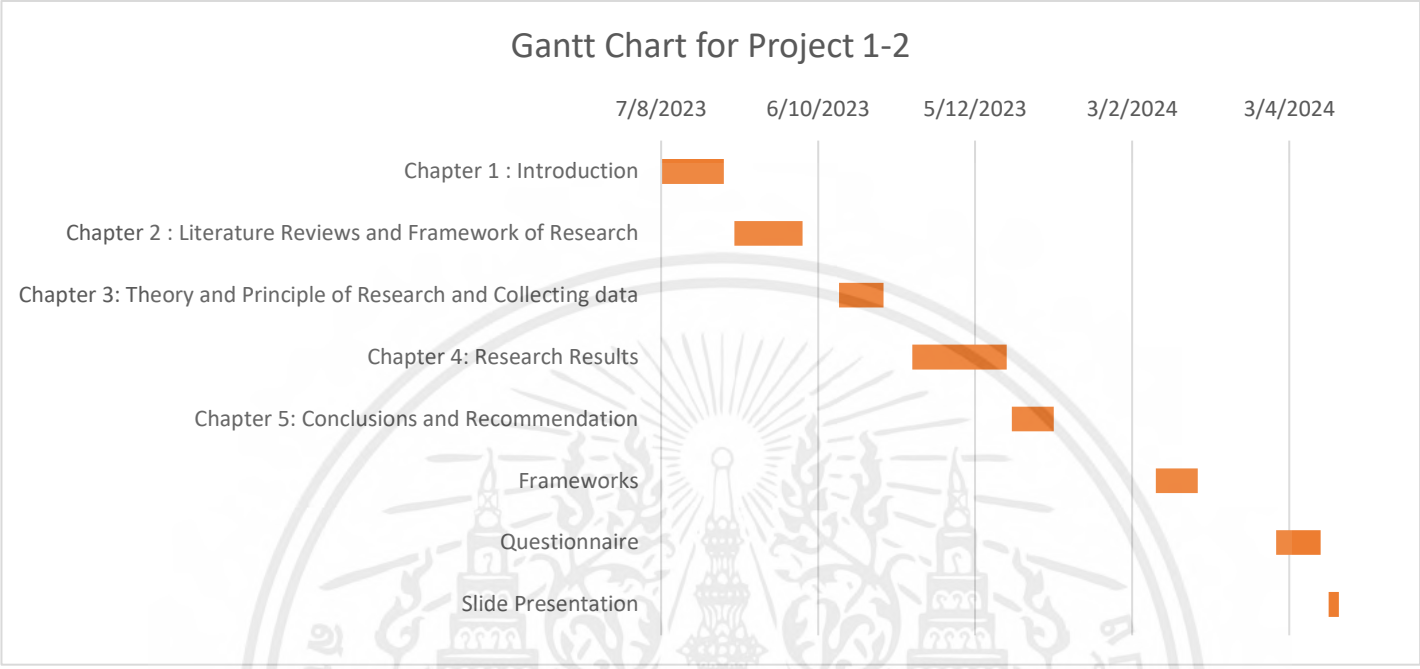

Figure 1: Planning of Research (Project 1-2)

1.7 Result and Expected Output

1.7.1 Curriculum Enhancement Recommendations: The research aims to provide valuable insights for curriculum improvement, ensuring alignment with local and regional data. The expected output includes specific recommendations and adjustments that can enhance the relevance and effectiveness of the curriculum.

1.7.2 Knowledge Enrichment for Students and Graduates: The research endeavors to generate knowledge that is mutually beneficial for current students and graduates. The expected output involves the creation of resources, materials, or guidelines that contribute to the practical applicability of knowledge acquired through the program.

1.7.3 Facilitation of Data Exchange: The research aims to establish channels for effective data exchange between students and various stakeholders such as organizations, institutions, some bodies in engineering job field, and programs. The expected output involves the

development of platforms or mechanisms that facilitate the seamless exchange of information, promoting career development opportunities.

1.7.4 Improved Program Reputation: Through the implementation of suggested curriculum improvements and the provision of valuable resources, the research anticipates contributing to the enhanced reputation of the Engineering Management and Entrepreneurship program. This can lead to increased enrollment, positive feedback from graduates, and a more favorable perception in the academic and professional communities.

Chapter 2

Literature Reviews and Framework of Research

2.1 Introduction

High school graduates aspire to pursue higher education at the university level, particularly in the field of engineering, which has consistently been one of the most popular faculties. They aim to enroll in prestigious educational institutions such as the School of Engineering at KMITL or the School of International and Interdisciplinary Engineering (SIIE), including programs like Engineering Management and Entrepreneurship (EME).

Engineering Management and Entrepreneurship (EME - International Program) combines engineering science, design, and business skills. This program includes management, entrepreneurship, and innovation. At the undergraduate level, students learn engineering fundamentals, coupled with planning, organization, resource allocation, and technology-driven activity supervision. The bachelor's degree in Engineering Management and Entrepreneurship provides budding engineers with knowledge of engineering business, enhancing their value to employers and ensuring professional growth in the future. It equips them to handle technological challenges, make decisions, manage engineering processes, and operate as entrepreneurs. This education encompasses a proactive attitude, work opportunities, and is divided into 6 job field and 18 job. The job field include Entrepreneurship, Management, Engineering, Built Environment, Logistics, and the Government Sector. Job consists of Engineering Entrepreneurs, Business Development Engineers, Engineering Management Analysts, Engineering Management Consultants, Facilities Engineers, Operations Engineers, Research and Development Engineers (R&D Engineers), General and Operations Engineers, Business Engineers, Store Engineers, Human Factory Engineers, Ergonomists, Cognitive Engineers, Manufacturing Engineers, Plant Engineers, Process Engineers, Marketing Engineers, Office Engineers, Administrative Services Engineers, Product Sales Engineers, Sales Engineers, Technical Sales Engineers, Purchasing Engineers, System Engineers, Validation Engineers, Reliability Engineers, Product Quality Engineers, Construction Engineers, Cost Engineers, Cost Estimators, Cost Consultants, Logistics Engineers, Reliability Engineers, Supportability Engineers, Systems Engineers, Supply Chain Engineers, Solution Design and Analysis Engineers, as well as Smart City and Infrastructure Engineers, Urban and Regional Engineers.

Professionals in the aforementioned career groups must possess the skills and abilities that align with their respective professions, enabling them to pursue their desired careers in both the public and private sectors. Therefore, it is essential for researchers to study and gain knowledge about the factors related to these topics. Researchers must gather data from both primary and secondary sources. Primary data can be collected by surveying companies using questionnaires. Secondary data can be obtained from the internet or Skill Mapping KMITL to align with the research framework.

2.2 Research Tools

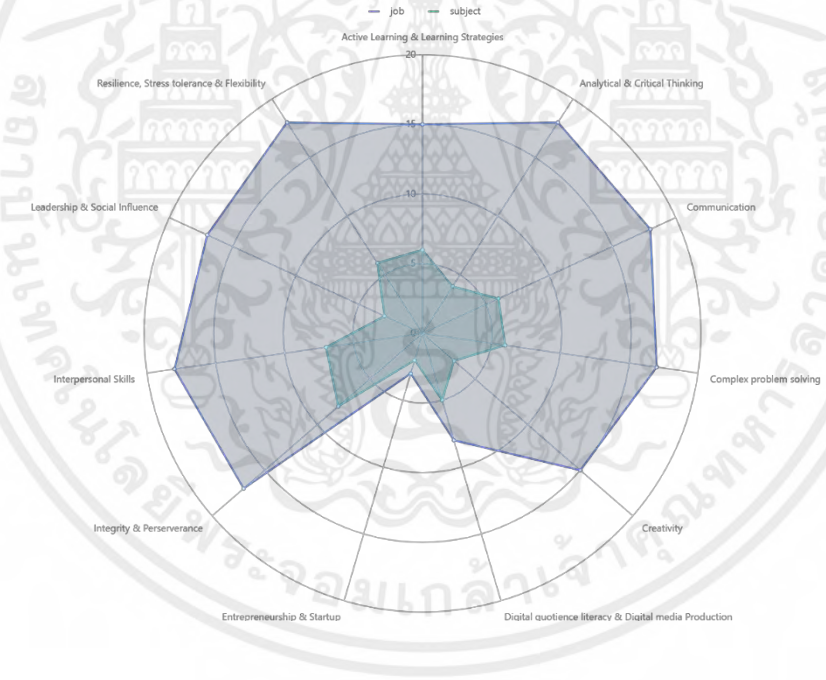

Figure 2: Skill Mapping KMITL General Skill of EME with jobs and subjects

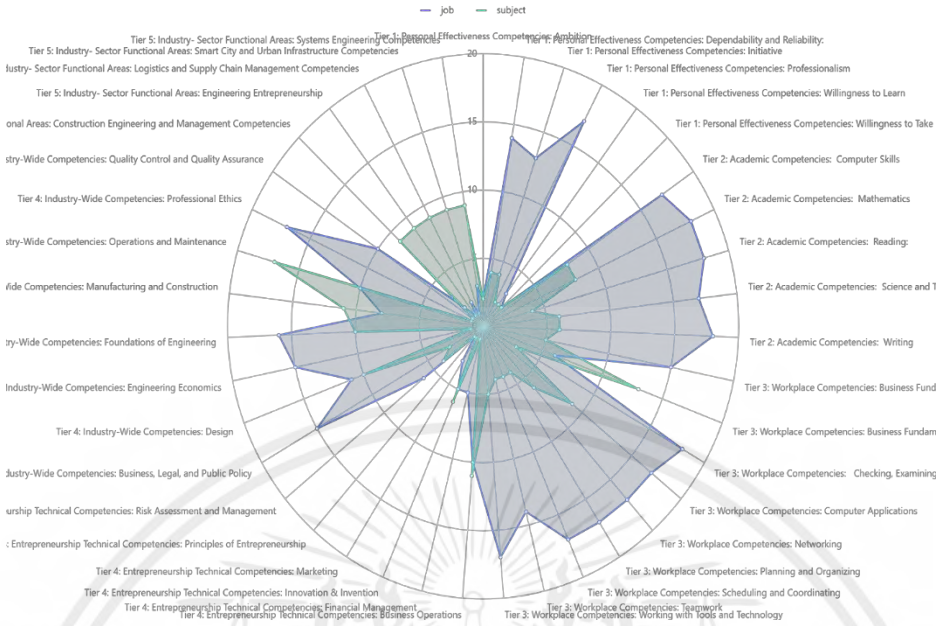

Figure 3: Skill Mapping KMITL Specific Skill of EME with jobs and subjects

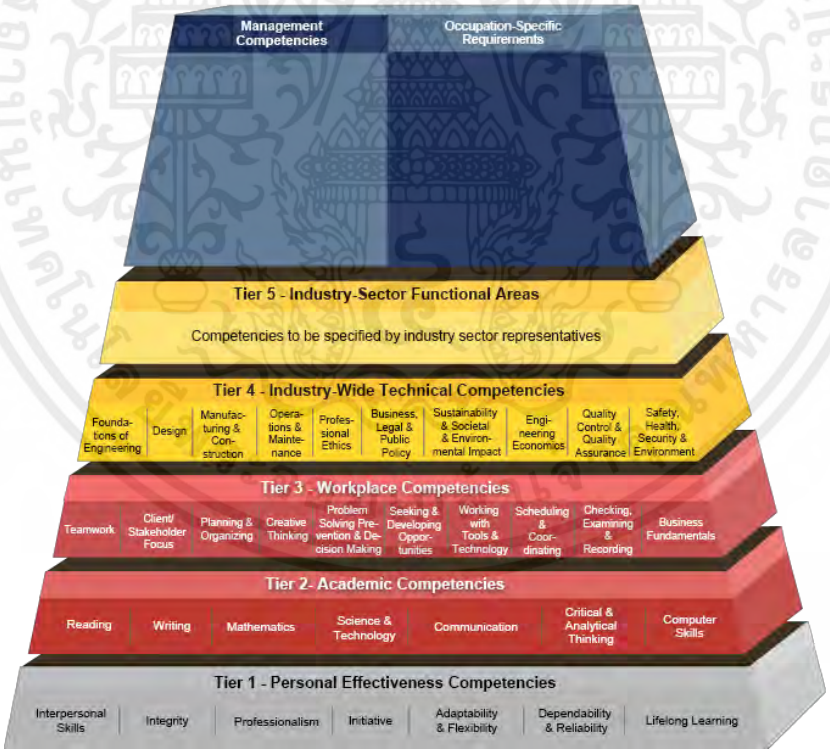

Figure 4: Engineering Competencies 5 Tiers, Management

Competencies and Occupation-Specific Requirements

Engineering competencies are often categorized into five tiers, ranging from entry-level to expert. These tiers represent the proficiency and experience levels of engineers in various disciplines. Management competencies involve skills related to leadership, project management, and communication. Occupation-specific requirements pertain to the unique skills and knowledge needed for a particular engineering field or role. These three components collectively define the skill set and qualifications expected from professionals in the engineering domain.

Figure 5: Entrepreneurship Competencies 5 Tiers, Management Competencies and Occupation-Specific Requirements

Entrepreneurship competencies are typically organized into five tiers, reflecting varying levels of proficiency and experience in entrepreneurial activities. Management competencies in

entrepreneurship encompass skills related to leadership, strategic planning, financial management, and team collaboration. Occupation-specific requirements in entrepreneurship refer to the specialized knowledge and skills needed for specific entrepreneurial roles or industries. Together, these components outline the diverse skill sets and qualifications expected from individuals engaged in entrepreneurship, ranging from entry-level to advanced expertise.

2.3 Article Research

Amanunddin S., et al. (2018) discusses the factors influencing accounting students at UNITEN in choosing entrepreneurship as their future career. The study finds that entrepreneur education, age, and personal attributes significantly influence students' choice, except for family influence. Despite government initiatives, graduates tend to seek stable employment due to concerns about economic problems. The research emphasizes the importance of early exposure to entrepreneurship and government efforts to positively influence graduates' entrepreneurial activities.

Lima, R. M., Mesquita, D., Rocha C., & Rabelo M. (2017) discusses the professional profiles in the field of engineering. The discussion helps understand professional practices, specify competences for various functions and company cultures, and forms the basis for curriculum development in engineering schools. The study analyzes 1,391 job advertisements from a Portuguese newspaper over seven years, categorizing them into professional practice areas and transversal competences. The analysis identifies 1,962 references for 11 professional practice areas and 5,261 references for transversal competences. The research highlights the main areas of practice and competences demanded by employers, emphasizing the need for collaboration between universities and business organizations to develop professionals aligned with industry requirements.

Yohana C., et al. (2020) discusses investigates the factors influencing entrepreneurship education and the development of entrepreneurial competencies in vocational high school students in Indonesia. The study focuses on external factors, including the role of school principals (PEC), entrepreneurship training (ETR), and the participation of business and industry players (BIP). The research aims to understand how these factors impact entrepreneurship education (EED), collaborative learning among students (SLC), and the development of students' entrepreneurial

competencies (SECD). The study collected data from 247 students in four district/city locations, analyzing the relationships between these variables using Structural Equation Modeling (SEM) with the Lisrel 87.0 program. The findings indicate that entrepreneurship education positively affects collaborative learning and the development of entrepreneurial competencies among students. The study emphasizes the importance of these external factors in shaping effective entrepreneurship education programs, especially for students who do not pursue higher education, addressing the challenges of unemployment by fostering independence, creativity, and entrepreneurial initiatives among graduates.

Inna, K., Anna, R., & Tonis, M. (2020) discusses investigates the relationship between experiential entrepreneurship pedagogy, entrepreneurial competencies, and the employment status of business graduates in two European countries. The research model, based on adapted Bloom's taxonomy, human capital theory, and experiential learning theory, examines knowledge, skills, and attitudes as competencies, linking them to two forms of employment status: nascent intrapreneurship and early-stage entrepreneurial activity. The study, conducted through a cross-sectional survey of 454 graduates and 16 semi-structured interviews with entrepreneurship educators, reveals that experiential pedagogy is more effective in developing entrepreneurial competencies compared to traditional pedagogy. Experiential pedagogy also moderates the relationship between competencies and graduates' employment status. The paper emphasizes the importance of combining traditional and experiential teaching methods to enhance entrepreneurship education outcomes.

Dotun, O., & David, O. (2018) discusses the factors influencing entrepreneurship intentions among fresh graduates in Nigeria, focusing on the link between entrepreneurship education and self-employment intentions. Despite the introduction of entrepreneurship development programs in Nigerian tertiary institutions, the country's unemployment rate has remained high. The study conducted a survey among 230 randomly selected National Youth Service Corp (NYSC) members in Ondo state. The results revealed that entrepreneurship education, ability to take risks, and the influence of family, friends, and mentors were significant determinants of entrepreneurial intentions among the participants. Additionally, entrepreneurship education had a positive impact on fresh graduates' business start-up intentions. The study suggests the establishment of more skills acquisition and innovation centers in Nigeria to equip young graduates with the necessary

skills and attitudes, transforming them into job creators rather than job seekers and ultimately reducing unemployment and criminal activities among Nigerian youths.

Manasa, K., Sojen, P., & Dilek, C. (2023) discusses the impact of digital technologies on the modern workplace, especially in light of the Covid-19 pandemic, which has made remote work prevalent. The research focuses on engineering management courses in Australian institutions, comparing the skills taught with those valued by engineering managers. The study emphasizes the importance of skills such as digital intelligence and empathy in the current digital age. It reviews 20 research articles, conducts interviews with ten Australian engineering managers, and analyzes six Australian university curriculums. The findings underline the significance of digital and emotional intelligence for managers and reveal a gap between the skills emphasized in the literature and those offered in Australian university programs.

Hazim, E., & Sameh, M., E. (2007) discusses the challenges faced by fast-developing countries, particularly in the United Arab Emirates (UAE), to harmonize economic growth. With a small percentage of UAE nationals, the government relies on them to manage the country. However, classical engineering programs do not prepare students for early management roles, hindering their success. The paper introduces an interdisciplinary engineering graduate program at the American University of Sharjah, aiming to develop Engineering Management core competencies in Gulf region graduates, addressing this gap.

Saumya, S. (2019) discusses the importance of soft skills for personal and professional development, especially for management graduates. Soft skills are highly valued by employers and enhance graduates' employability. The paper discusses how possessing effective soft skills is essential for career success and smooth progression. It reviews historical perspectives on job readiness from both employer and graduate viewpoints, highlighting trending soft skills desired by employers. The paper provides insights into how management graduates can learn and improve these skills as they transition from campus to the corporate world.

Christopher, V., B. (2020) discusses to develop a comprehensive framework of competencies for engineering managers using an inductive research design. The study explores three main research questions: the current competencies for engineering managers, future engineering management competencies based on future perspectives and trends, and the generation of a competency framework for engineering management. The research approach

involves Grounded Theory Method (GTM) and integrates existing literature to identify and code engineering management competencies. The results provide a theoretical framework encompassing competency areas and specific competencies essential for engineering management. This framework bridges gaps in the existing knowledge, offering a cohesive understanding of competencies within the discipline. The study discusses various competencies, considering context, environment, and human factors, and emphasizes the importance of Systems Theory. The developed competency framework supports organizations by proactively uniting diverse competencies, enhancing operations, and overall performance within the engineering management discipline.

2.4 Framework of Research

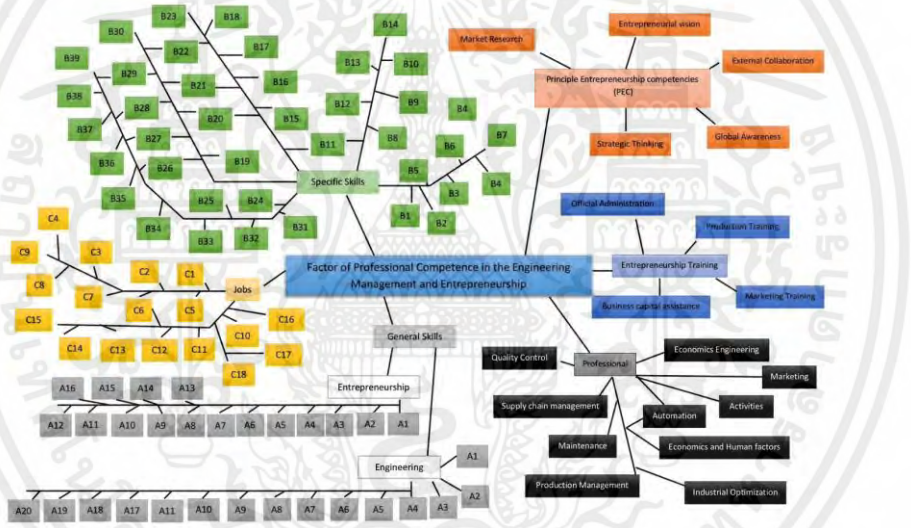

Figure 6: Framework of Research

Variables (Protected View)

A1: Active Learning and Learning Strategies

A2: Analytical and Critical Thinking

A3: Communication

A4: Complex problem solving

A5: Creativity

A6: Digital Quotient Literacy & Digital Media Production

A7: Entrepreneurship & Startup

A8: Integrity & Perseverance

A9: Interpersonal Skills

A10: Resilience, Stress Tolerance & Flexibility

A11: Leadership & Social Influence

A12: Critical Thinking

A13: Risk Management

A14: Emotional Intelligence

A15: Continuous Learning

A16: Willingness to Take Risk

A17: Technical Proficiency

A18: Attention to Detail

A19: Mathematics and Science Knowledge

A20: Safety Awareness

B1: Ambition

B2: Willingness to Learn

B3: Willingness to Take Risks

B4: Business Fundamentals for Entrepreneurship

B5: Computer Applications

B6: Networking

B7: Business Operations

B8: Financial Management

B9: Innovation & Invention

B10: Marketing

B11: Principles of Entrepreneurship

B12: Risk Assessment and Management

B13: Engineering Entrepreneurship

B14: Dependability and Reliability

B15: Initiative

B16: Professionalism

B17: Business Fundamentals for Engineering

B18: Planning and Organizing

B19: Scheduling and Coordinating

B20: Teamwork

B21: Business, Legal, and Public Policy

B22: Computer Skills

B23: Mathematics

B24: Reading

B25: Science and Technology

B26: Writing

B27: Checking, Examining, and Recording

B28: Working with Tools and Technology

B29: Design

B30: Engineering Economics

B31: Foundations of Engineering

B32: Manufacturing and Construction

B33: Operations and Maintenance

B34: Professional Ethics

B35: Quality Control and Quality Assurance

B36: Construction Engineering and Management

B37: Logistics and Supply Chain Management

B38: Smart City and Urban Infrastructure Competencies

B39: Systems Engineering Competencies

C1: Engineering Entrepreneur

C2: Business Development Engineer

C3: Engineering Management Analysts, Engineering Management Consultant

C4: Facilities Engineer / Operations Engineer / Research and Development Engineer

C5: General and Operations Engineer, Business Engineer, Store Engineer

C6: Human Factors Engineer, Ergonomists, Cognitive Engineer

C7: Manufacturing Engineers / Plant Engineer / Process Engineer

C8: Marketing Engineer

C9: Office Engineer, Administrative Services Engineer

C10: Product Sales Engineer, Sales Engineer, Technical Sales Engineer

C11: Purchasing Engineer

C12: System Engineer

C13: Validation Engineer / Reliability Engineer / Product Quality Engineer

C14: Construction Engineer

C15: Cost Engineer, Cost Estimator, Cost Consultant

C16: Logistics Engineer, Reliability Engineer, Supportability Engineer, Systems Engineer

C17: Supply Chain Engineer, Solution Design and Analysis Engineer

C18: Smart City and Infrastructure Engineers / Urban and Regional Engineers

Chapter 3

Theory and Principle of Research and Collecting data

3.1 Introduction

This chapter explores the factors influencing professional competence in the Engineering Management and Entrepreneurship (EME) program. In a rapidly changing professional landscape,

the skills and attributes developed in this program are integral for graduates navigating the intersection of engineering and entrepreneurship. This investigation sheds light on key competencies shaping the success of EME graduates.

3.2 Theory and Principle

3.2.1 Competencies

Competencies refer to a combination of knowledge, skills, abilities, and behaviors that individuals demonstrate to perform tasks or achieve specific outcomes effectively in various contexts.

They often encompass a broader range of attributes beyond just technical skills, including cognitive abilities, interpersonal skills, emotional intelligence, and other personal characteristics.

Competencies are typically defined based on the requirements of a particular role, job, or profession and are often tied to organizational goals and objectives.

Examples of competencies include communication skills, problem-solving abilities, adaptability, leadership, teamwork, and ethical decision-making.

3.2.2 Skills

Skills are specific learned abilities that enable individuals to perform particular tasks or activities proficiently. They are usually more focused and tangible than competencies.

Skills can be acquired through training, education, practice, and experience. They are often developed and honed over time through deliberate effort and repetition.

Unlike competencies, which encompass a broader set of attributes, skills are typically more task-oriented and specific to particular functions or domains.

Examples of skills include technical skills (e.g., programming, data analysis, mechanical repair), soft skills (e.g., communication, teamwork, time management), and specialized skills (e.g., language proficiency, project management).

3.2.3 Skill Mapping at KMITL

3.2.3 (1) General skill or soft skill

Active Learning & Learning Strategies: Actively participating in the learning process, utilizing techniques such as discussions, problem-solving, and practical applications to enhance understanding and retention.

Resilience, Stress Tolerance & Flexibility: Resilience involves bouncing back from setbacks, stress tolerance is the ability to handle pressure, and flexibility is adapting to changes, crucial for navigating dynamic work environments.

Analytical & Critical Thinking: Analytical thinking involves breaking down complex problems into manageable parts, while critical thinking emphasizes evaluating information objectively, fostering sound decision-making.

Leadership & Social Influence: Leadership is guiding a team toward common goals, and social influence is the positive impact one has on others, vital for effective teamwork and achieving objectives.

Communication: Effective communication involves conveying ideas clearly and succinctly, whether through speaking, writing, or non-verbal cues, facilitating smooth interactions.

Interpersonal Skills: Building positive relationships, understanding others, resolving conflicts, and collaborating effectively with diverse individuals, promoting a healthy work environment.

Complex Problem Solving: The ability to approach intricate problems methodically, breaking them down into manageable components and developing innovative solutions.

Integrity & Perseverance: Upholding ethical standards, honesty, and demonstrating unwavering determination in the face of challenges, contributing to a trustworthy and resilient character.

Creativity: Encouraging unconventional thinking, fostering an environment where novel ideas are generated, contributing to innovation and problem-solving.

Entrepreneurship & Startup: Involves identifying business opportunities, taking calculated risks, and creating value—essential for those interested in starting and managing businesses.

Digital Quotient Literacy & Digital Media Production: Digital quotient literacy is the ability to use digital technologies effectively, and digital media production involves c and managing content in various digital formats, crucial in today's tech-driven world.

3.2.3 (2) Specific Skill for each of Job Field

3.2.3 (2.2.1) Entrepreneurship

Tier 1: Personal Effectiveness Competencies

1. Ambition: Demonstrating a strong desire and dedication to achieving goals.

2. Willingness to Learn: Displaying openness to acquiring and applying new knowledge and skills.

3. Willingness to Take Risks: Showing a readiness to accept risks associated with entrepreneurial activities.

Tier 3: Workplace Competencies

1. Business Fundamentals for Entrepreneurship: Applying knowledge of basic business principles, trends, and economics to work activities.

2. Computer Applications: Using computer and related applications proficiently for information input and retrieval.

3. Networking: Establishing and nurturing professional relationships and partnerships.

Tier 4: Entrepreneurship Technical Competencies

1. Business Operations: Executing ongoing activities involved in running a business.

2. Financial Management: Managing and controlling finances and assets for successful entrepreneurial activities.

3. Innovation & Invention: Formulating new ideas and applications for processes and products.

4. Marketing: Planning and executing strategies to promote and sell products, services, and ideas.

5. Principles of Entrepreneurship: Understanding processes and characteristics central to entrepreneurial activities.

6. Risk Assessment and Management: Developing a structured approach to managing uncertainty and evaluating, assuming, and mitigating risks.

Tier 5: Industry-Sector Functional Areas - Engineering Entrepreneurship

1. Youth and Undergraduate Entrepreneurship

2. Micro-Enterprise

3. Small Business Development

4. Social Entrepreneurship

5. High-Growth, High-Value Entrepreneurship

3.2.3 (2.2) Management

Tier 1: Personal Effectiveness Competencies

1. Dependability and Reliability: Displaying responsible behaviors at work.

2. Initiative: Demonstrating commitment to effective job performance by taking action independently and following through.

Tier 1: Personal Effectiveness Competencies

1. Professionalism: Maintaining a professional presence.

Tier 3: Workplace Competencies

1. Business Fundamentals for Engineering: Using information on basic business principles, trends, and economics.

2. Planning and Organizing: Prioritizing work and managing time effectively to accomplish assigned tasks.

3. Scheduling and Coordinating: Making arrangements efficiently and economically to fulfill all requirements.

4. Teamwork: Collaborating with others to complete work assignments.

Tier 4: Industry-Wide Competencies

1. Business, Legal, and Public Policy: Understanding and managing activities associated with business management and operations. Knowledge of relevant local, national, and international laws and regulations impacting the field of engineering.

3.2.3 (2.3) Engineering

Tier 2: Academic Competencies: Computer Skills

1. Computer Skills: Using information technology and related applications to convey and retrieve information.

2. Mathematics: Applying mathematical principles to express ideas and solve problems.

3. Reading: Understanding written sentences, paragraphs, and figures in work-related documents.

4. Science and Technology: Applying scientific rules and methods to express ideas and solve problems.

5. Writing: Using standard business English to compile information and prepare written documents.

Tier 3: Workplace Competencies

1. Checking, Examining, and Recording: Entering, transcribing, recording, storing, or maintaining information in written or electronic format.

2. Working with Tools and Technology: Selecting, using, and maintaining modern engineering tools and technology.

Tier 4: Industry-Wide Competencies

1. Design: Devising systems, components, or processes to meet desired needs.

2. Engineering Economics: Applying economics to engineering projects.

3. Foundations of Engineering: Understanding engineering fundamentals and their interactions with society.

4. Manufacturing and Construction: Managing the process of converting or assembling materials into higher-value products.

5. Operations and Maintenance: Overseeing the setup, operation, control, maintenance, and improvement of technology supporting production.

6. Professional Ethics: Displaying strong engineering ethics in evaluating and applying the merits, risks, and social concerns of engineering activities.

7. Quality Control and Quality Assurance: Ensuring products and processes meet quality requirements.

Tier 5: Industry-Sector Functional Areas

1. Construction Engineering and Management Competencies: Key competencies with project and construction management indicators.

2. Logistics and Supply Chain Management Competencies: Driving increased revenue, cost savings, and simplifying distribution networks.

3. Smart City and Urban Infrastructure Competencies.

4. Systems Engineering Competencies: Skills for technical engineers, project team members, subsystem leads, and program/systems engineers.

3.2.3 (3) Job 18 Jobs

3.2.3 (3.1) Engineering Entrepreneur

Job Duty

Seek new directions and ways to improve and grow the company Responsible for the final decision on strategic and sometimes operational matters Oversee financial records and take action such as securing a new line of credit to handle unforeseen events Set the direction and establish the desired image for the business Responsible for the overall marketing plan for the business Manage the company’s incoming calls, emails, visitors, and inquiries. Also, make

outbound calls; respond to emails and rescheduling appointments as needed Attend to clients and ensure customer satisfaction. May introduce adjustments to products and services Carry out the HR function for the business Perform all other duties necessary for the organization to achieve its goals. Tiers 1 through 3 contain Foundational Competencies, which form the foundation needed to be ready to engage in entrepreneurship.

• Tier 1: Personal Effectiveness Competencies represent personal attributes or "soft skills." Essential for all life roles, personal effectiveness competencies generally are learned in the home or community and reinforced at school and in the workplace.

• Tier 2: Academic Competencies are critical competencies primarily learned in a school setting. They include cognitive functions and thinking styles that are likely to apply to most industries and occupations.

• Tier 3: Workplace Competencies represent motives and traits, as well as interpersonal and self-management styles. They generally are applicable to many occupations and industries. Tiers 4 and 5 contain Industry Competencies, which are specific to entrepreneurship. Cross-cutting technical competencies make it possible to create career lattices within an industry wherein an entrepreneur can move easily across sectors and sub-sectors. Rather than narrowly following a single occupational career ladder, this model supports the development of an agile entrepreneurial workforce.

• Tier 4: Entrepreneurship Technical Competencies represent the knowledge and skills that are common to all entrepreneurial activities. These technical competencies build on, but are more specific than, competencies represented on lower tiers.

• Tier 5: Entrepreneurial Focus Area Technical Competencies represent a sub-set of entrepreneurship technical competencies that are specific to a sector or sub-sector. The Employment and Training Administration’s Engineering model does not include Tier 5 competencies, but users may develop Tier 5 competencies to meet the needs of entrepreneurs in a specific sector.

3.2.3 (3.2) Business Development Engineer

Job Duty

Description: what do Business Development Engineer do?

Analyze potential and existing markets in order to identify business opportunities Establish customer base relations and its management data base Carry out market research in order to develop strategies and roadmaps for sales of the company's products and to secure more business relations Develop and maintain good customer relationship for the future growth of the company Provide support to marketing team, in the area of developing strategies for company's product promotions Prepare presentations, proposals, and various sales tools on effective development of business opportunities for the company Assist the relevant management in resourcing, budgeting, and problem solving activities of the company Develop campaigns and other activities that will help in increasing the recognition of the company. Regularly provide updates on the market competition analysis and knowledge to the sales and service department Research conditions in local, regional, national, or online markets. Gather information to determine potential sales of a product or service, or plan a marketing or advertising campaign. May gather information on competitors, prices, sales, and methods of marketing and distribution. May employ search marketing tactics, analyze web metrics, and develop recommendations to increase search engine ranking and visibility to target markets.

Also known as: Business Development Engineer, Communications Specialist, Demographic Analyst, Market Analyst, Market Research Analyst, Market Research Consultant, Market Research Specialist, Market Researcher

Programs that can prepare for Business Development Engineer:

- Apparel and Accessories Marketing Operations
- Apparel and Textile Marketing Management
- Applied Economics
- Business Analytics
- Business and Personal/Financial Services Marketing Operations
- Consumer Merchandising/Retailing Management
- Digital Marketing
- Hospitality and Recreation Marketing Operations

- International Marketing
- Marketing Research
- Marketing, Other
- Marketing/Marketing Management, General
- Special Products Marketing Operations
- Tourism Promotion Operations
- Tourism and Travel Services Marketing Operations
- Vehicle and Vehicle Parts and Accessories Marketing Operations

Activities: what Business Development Engineer might do in a day?

- Prepare research reports.
- Analyze consumer trends.
- Conduct surveys in organizations.
- Establish business management methods.
- Measure effectiveness of business strategies or practices.
- Gather organizational performance information.
- Analyze market conditions or trends.
- Analyze industry trends.
- Monitor business indicators.
- Discuss business strategies, practices, or policies with managers.
- Supervise employees.
- Develop business or market strategies.

Knowledge

People in this career often know a lot about:

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Sales and Marketing - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• Communications and Media - Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media.

• Administrative - Knowledge of administrative and office procedures and systems such as word processing, managing files and records, stenography and transcription, designing forms, and workplace terminology.

Skills

People in this career often have these skills:

• Writing - Writing things for co-workers or customers.

• Reading Comprehension - Reading work-related information.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Speaking - Talking to others. • Active Listening - Listening to others, not interrupting, and asking good questions.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.
• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Active Learning - Figuring out how to use new ideas or things.

Abilities

People in this career often have talent in:

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Oral Comprehension - Listening and understanding what people say.

• Deductive Reasoning - Using rules to solve problems.

• Fluency of Ideas - Coming up with lots of ideas.

• Oral Expression - Communicating by speaking.

• Written Expression - Communicating by writing.

• Written Comprehension - Reading and understanding what is written.

• Information Ordering - Ordering or arranging things.

• Category Flexibility - Grouping things in different ways.

• Speech Clarity - Speaking clearly.

• Near Vision - Seeing details up close.

• Problem Sensitivity - Noticing when problems happen.

• Originality - Creating new and original ideas.

• Mathematical Reasoning - Choosing the right type of math to solve a problem.

Related occupations

- Survey Researchers
- Marketing Managers
- Compensation, Benefits, and Job Analysis Specialists
- Compensation and Benefits Managers
- Management Analysts
- Public Relations Specialists
- Regulatory Affairs Specialists
- Advertising and Promotions Managers

3.2.3 (3.3) Engineering Management Analysts, Engineering Management Consultant

Job Duty

Description: what do they do?

Conduct organizational studies and evaluations, design systems and procedures, conduct work simplification and measurement studies, and prepare operations and procedures manuals to assist Engineering Management in operating more efficiently and effectively. Includes program analysts and Engineering Management consultants.

Also known as: Administrative Analyst, Business Analyst, Employment Programs Analyst, Engineering Management Analyst, Engineering Management Consultant, Organizational Development Consultant, Program Engineering Management Analyst, Quality Control Analyst

Programs that can prepare you:

- Applied Statistics, General
- Business Administration and Engineering Management, General
- Business Analytics
- Business/Commerce, General

- Business/Managerial Economics
- Data Analytics, General
- Data Analytics, Other
- Data Visualization
- Educational Assessment, Evaluation, and Research, Other
- Educational Assessment, Testing, and Measurement
- Educational Evaluation and Research
- Educational Statistics and Research Methods
- Financial Analytics • Industrial and Organizational Psychology
- Institutional Research
- Engineering Management Science
- Organizational Leadership

Activities: what you might do in a day

- Advise others on business or operational matters.
- Prepare research reports.
- Analyze jobs using observation, survey, or interview techniques.
- Analyze business or financial data.
- Confer with personnel to coordinate business operations.
- Gather organizational performance information.
- Develop training materials.
- Train personnel in organizational or compliance procedures.
- Discuss business strategies, practices, or policies with managers.
- Develop business or financial information systems.

Knowledge

People in this career often know a lot about:

• Administration and Engineering Management - Knowledge of business and Engineering Management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar. c

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Education and Training - Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.

• Psychology - Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders.

• Personnel and Human Resources - Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labor relations and negotiation, and personnel information systems.

• Sales and Marketing - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.

Skills

People in this career often have these skills:

• Critical Thinking - Thinking about the pros and cons of different ways to

solve a problem.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Reading Comprehension - Reading work-related information.

• Speaking - Talking to others.

• Writing - Writing things for co-workers or customers.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Systems Evaluation - Measuring how well a system is working and how to improve it.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Social Perceptiveness - Understanding people's reactions.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Systems Analysis - Figuring out how a system should work and how changes in the future will affect it.

• Coordination - Changing what is done based on other people's actions.

• Active Learning - Figuring out how to use new ideas or things.

Abilities

People in this career often have talent in:

• Oral Comprehension - Listening and understanding what people say.

• Oral Expression - Communicating by speaking.

• Written Comprehension - Reading and understanding what is written.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Written Expression - Communicating by writing.

- Deductive Reasoning - Using rules to solve problems.
- Problem Sensitivity - Noticing when problems happen.
- Speech Clarity - Speaking clearly.
- Information Ordering - Ordering or arranging things.
- Fluency of Ideas - Coming up with lots of ideas.
- Speech Recognition - Recognizing spoken words.
- Near Vision - Seeing details up close.

Related occupations

- Human Resources Specialists
- Training and Development Specialists
- Fraud Examiners, Investigators and Analysts
- Market Research Analysts and Marketing Specialists
- Marketing Managers
- Regulatory Affairs Managers
- Purchasing Agents, Except Wholesale, Retail, and Farm Products
- Transportation, Storage, and Distribution Managers
- Logisticians
- Training and Development Managers

3.2.3 (3.4) Facilities Engineer / Operations Engineer / Research and Development Engineer (R and D Engineer)

Job Duty

Description: what do they do?

Design, develop, test, and evaluate integrated systems for managing industrial production processes, including human work factors, quality control, inventory control, logistics and material flow, cost analysis, and production coordination. Assistant factory/ industry/ facilities, office, checking, examining, recording, planning, organizing, networking, coordinating, communication, procurement, purchasing, maintenance, plant, health, safety, human resource, process, planning and control

Also known as:

Continuous Improvement Engineer, Engineer, Facilities Engineer, Industrial Engineer, Operations Engineer, Plant Engineer, Process Engineer, Project Engineer, Quality Engineer, Research and Development Engineer (R and D Engineer)

Programs that can prepare this job:

- Engineering/Industrial Management
- Industrial Engineering
- Manufacturing Engineering
- Packaging Science
- Systems Engineering

Activities: what you might do in a day

- Estimate operational costs.
- Determine operational methods.
- Analyze project data to determine specifications or requirements.
- Communicate technical information to suppliers, contractors, or regulatory agencies.
- Discuss designs or plans with clients.
- Confer with technical personnel to prepare designs or operational plans.

• Evaluate designs or specifications to ensure quality.

• Recommend technical design or process changes to improve efficiency, quality, or performance.

• Document technical design details.

• Create graphical representations of industrial production systems.

• Supervise engineering or other technical personnel.

• Develop technical methods or processes.

• Review technical documents to plan work.

• Prepare contracts, disclosures, or applications.

• Prepare operational reports.

• Prepare procedural documents.

• Implement design or process improvements.

• Direct quality control activities.

• Analyze design or requirements information for mechanical equipment or systems.

• Schedule operational activities.

• Devise research or testing protocols.

Knowledge

People in this career often know a lot about:

• Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

• Production and Processing - Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

• Mechanical - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.

• Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

Skills

People in this career often have these skills:

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Reading Comprehension - Reading work-related information.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Speaking - Talking to others.

• Writing - Writing things for co-workers or customers.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

Abilities

People in this career often have talent in:

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Deductive Reasoning - Using rules to solve problems.

• Oral Expression - Communicating by speaking.

• Oral Comprehension - Listening and understanding what people say.

• Written Comprehension - Reading and understanding what is written.

• Written Expression - Communicating by writing.

• Problem Sensitivity - Noticing when problems happen.

• Information Ordering - Ordering or arranging things.

• Near Vision - Seeing details up close.

• Category Flexibility - Grouping things in different ways.

• Selective Attention - Paying attention to something without being distracted. Related occupations

• Validation Engineers

• Industrial Engineering Technologists and Technicians

• Materials Engineers

• Electrical Engineers

• Energy Engineers, Except Wind and Solar

• Mechanical Engineers

• Logistics Analysts

• Health and Safety Engineers, Except Mining Safety Engineers and Inspectors

• Fire-Prevention and Protection Engineers

3.2.3 (3.5) General and Operations Engineer, Business Engineer, Store Engineer

Job Duty

Description: what do they do?

Plan, direct, or coordinate the operations of public or private sector organizations, overseeing multiple departments or locations. Duties and responsibilities include formulating policies, managing daily operations, and planning the use of materials and human resources, but are too diverse and general in nature to be classified in any one functional area of management or administration, such as personnel, purchasing, or administrative services. Usually manage through subordinate supervisors. Excludes First-Line Supervisors.

Also known as:

Business Engineer, General Engineer, Operations Director, Operations Engineer, Plant Superintendent, Store Engineer

Programs that can prepare you:

- Business Administration and Management, General
- Business/Commerce, General
- Entrepreneurship/Entrepreneurial Studies
- Finance, General
- Financial Risk Management
- International Business/Trade/Commerce
- Management Science
- Non-Profit/Public/Organizational Management
- Parks, Recreation, and Leisure Facilities Management, General
- Parks, Recreation, and Leisure Facilities Management, Other
- Public Administration
- Retail Management

- Risk Management
- Social Entrepreneurship
- Veterinary Office Management/Administration

Activities: what you might do in a day

- Analyze financial records to improve efficiency.
- Analyze data to inform operational decisions or activities.
- Direct organizational operations, projects, or services.
- Direct sales, marketing, or customer service activities.
- Prepare staff schedules or work assignments.
- Determine pricing or monetary policies.
- Monitor performance of organizational members or partners.
- Direct financial operations.
- Provide basic information to guests, visitors, or clients.
- Develop organizational goals or objectives.
- Implement organizational process or policy changes.
- Develop organizational policies or programs.
- Conduct employee training programs.
- Hire personnel.
- Develop marketing plans or strategies.
- Manage construction activities.
- Recommend organizational process or policy changes.
- Determine resource needs.
- Manage environmental sustainability projects.
- Plan facility layouts or designs.

Knowledge

People in this career often know a lot about:

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Personnel and Human Resources - Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labor relations and negotiation, and personnel information systems.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Administrative - Knowledge of administrative and office procedures and systems such as word processing, managing files and records, stenography and transcription, designing forms, and workplace terminology.

• Sales and Marketing - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.

• Economics and Accounting - Knowledge of economic and accounting principles and practices, the financial markets, banking, and the analysis and reporting of financial data.

• Production and Processing - Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

Skills

People in this career often have these skills:

• Speaking - Talking to others.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Coordination - Changing what is done based on other people's actions.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Social Perceptiveness - Understanding people's reactions.

• Reading Comprehension - Reading work-related information.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Time Management - Managing your time and the time of other people.

• Negotiation - Bringing people together to solve differences.

• Active Learning - Figuring out how to use new ideas or things.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Management of Personnel Resources - Selecting and managing the best workers for a job.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Persuasion - Talking people into changing their minds or their behavior.

Abilities

People in this career often have talent in:

• Speech Clarity - Speaking clearly.

• Problem Sensitivity - Noticing when problems happen.

• Written Expression - Communicating by writing.

• Written Comprehension - Reading and understanding what is written.

• Oral Expression - Communicating by speaking.

• Oral Comprehension - Listening and understanding what people say.

• Speech Recognition - Recognizing spoken words.

• Deductive Reasoning - Using rules to solve problems.

• Information Ordering - Ordering or arranging things.

Related occupations

- First-Line Supervisors of Material-Moving Machine and Vehicle Operators
- First-Line Supervisors of Office and Administrative Support Workers
- Administrative Services Engineers
- Lodging Engineers
- Transportation, Storage, and Distribution Engineers
- Gambling Engineers
- Purchasing Engineers
- Food Service Engineers
- Wholesale and Retail Buyers, Except Farm Products

3.2.3 (3.6) Human Factors Engineer, Ergonomists, Cognitive Engineer

Job Duty

Description: what do they do?

Design objects, facilities, and environments to optimize human well-being and overall system performance, applying theory, principles, and data regarding the relationship between humans and respective technology. Investigate and analyze characteristics of human behavior and performance as it relates to the use of technology. Also known as: Certified Professional Ergonomist, Cognitive Engineer, Consulting Ergonomist, Ergonomic Consultant, Ergonomics Consultant, Ergonomics Technical Advisor, Ergonomist, Human Factors Advisor, Human Factors Engineer, Occupational Ergonomist

Programs that can prepare you:

- Engineering/Industrial Management
- Industrial Engineering
- Manufacturing Engineering
- Packaging Science
- Systems Engineering

Activities: what you might do in a day

• Analyze operational data to evaluate operations, processes or products.

• Develop technical methods or processes.

• Advise others on health and safety issues.

• Devise research or testing protocols.

• Document design or operational test results.

• Inspect facilities or sites to determine if they meet specifications or standards.

• Research human performance or health factors related to engineering or design activities.

• Confer with technical personnel to prepare designs or operational plans.

• Prepare proposal documents.

• Train personnel on proper operational procedures.

• Determine operational criteria or specifications.

• Assess product or process usefulness.

• Investigate safety of work environment.

• Estimate technical or resource requirements for development or production projects.

• Estimate time requirements for development or production projects.

• Create models of engineering designs or methods.

• Test performance of electrical, electronic, mechanical, or integrated systems or equipment.

• Recommend technical design or process changes to improve efficiency, quality, or performance.

• Prepare procedural documents.

Knowledge

People in this career often know a lot about:

• Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

• Psychology - Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Education and Training - Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.

• Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

Skills

People in this career often have these skills:

• Reading Comprehension - Reading work-related information.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Speaking - Talking to others.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Writing - Writing things for co-workers or customers.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Active Learning - Figuring out how to use new ideas or things.

• Systems Evaluation - Measuring how well a system is working and how to improve it.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Social Perceptiveness - Understanding people's reactions.

Abilities

People in this career often have talent in:

• Written Comprehension - Reading and understanding what is written.

• Deductive Reasoning - Using rules to solve problems.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Written Expression - Communicating by writing.

• Oral Comprehension - Listening and understanding what people say.

• Oral Expression - Communicating by speaking.

• Problem Sensitivity - Noticing when problems happen.

• Information Ordering - Ordering or arranging things.

• Speech Clarity - Speaking clearly.

• Speech Recognition - Recognizing spoken words.

• Fluency of Ideas - Coming up with lots of ideas.

• Category Flexibility - Grouping things in different ways.

• Near Vision - Seeing details up close.

• Originality - Creating new and original ideas.

3.2.3 (3.7) Manufacturing Engineers / Plant Engineer / Process Engineer

Job Duty

Description: what do they do?

Design, integrate, or improve manufacturing systems or related processes. May work with commercial or industrial designers to refine product designs to increase producibility and decrease costs.

Also known as:

Facility Engineer, Manufacturing Engineer, Plant Engineer, Process Engineer, Process Improvement Engineer

Programs that can prepare you:

- Engineering/Industrial Management
- Industrial Engineering
- Manufacturing Engineering
- Packaging Science
- Systems Engineering

Activities: what you might do in a day

- Determine causes of operational problems or failures.
- Resolve operational performance problems.
- Analyze operational data to evaluate operations, processes or products.
- Develop technical methods or processes.
- Implement design or process improvements.
- Determine operational methods.
- Provide technical guidance to other personnel.
- Design industrial processing systems.
- Evaluate designs or specifications to ensure quality.

• Recommend technical design or process changes to improve efficiency, quality, or performance.

• Prepare operational reports.

• Create graphical representations of industrial production systems.

• Prepare procedural documents.

• Confer with technical personnel to prepare designs or operational plans.

• Supervise production or support personnel.

• Design industrial equipment.

• Assess product or process usefulness.

• Install production equipment or systems.

• Estimate technical or resource requirements for development or production projects. • Estimate operational costs.

• Estimate time requirements for development or production projects.

• Train personnel on proper operational procedures.

• Devise research or testing protocols.

• Analyze costs and benefits of proposed designs or projects.

• Purchase materials, equipment, or other resources.

• Investigate the environmental impact of projects.

• Update technical knowledge.

• Develop operational methods or processes that use green materials or emphasize sustainability.

Knowledge

People in this career often know a lot about:

• Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

• Production and Processing - Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

• Mechanical - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.

• Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Physics - Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes.

Skills

People in this career often have these skills:

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Mathematics - Using math to solve problems.

• Reading Comprehension - Reading work-related information.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Speaking - Talking to others.

• Operations Monitoring - Watching gauges, dials, or display screens to make sure a machine is working.

• Systems Evaluation - Measuring how well a system is working and how to improve it.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Systems Analysis - Figuring out how a system should work and how changes in the future will affect it.

• Writing - Writing things for co-workers or customers.

• Technology Design - Making equipment and technology useful for customers.

• Active Learning - Figuring out how to use new ideas or things.

• Time Management - Managing your time and the time of other people.

• Troubleshooting - Figuring out what is causing equipment, machines, wiring, or computer programs to not work.

Abilities

People in this career often have talent in:

• Near Vision - Seeing details up close.

• Category Flexibility - Grouping things in different ways.

• Deductive Reasoning - Using rules to solve problems.

• Problem Sensitivity - Noticing when problems happen.

• Oral Comprehension - Listening and understanding what people say.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Visualization - Imagining how something will look after it is moved around or changed.

• Oral Expression - Communicating by speaking.

• Information Ordering - Ordering or arranging things.

• Written Comprehension - Reading and understanding what is written.

• Number Facility - Adding, subtracting, multiplying, or dividing.

• Mathematical Reasoning - Choosing the right type of math to solve a problem.

• Flexibility of Closure - Seeing hidden patterns.

• Fluency of Ideas - Coming up with lots of ideas.

• Written Expression - Communicating by writing.

• Originality - Creating new and original ideas.

• Speech Recognition - Recognizing spoken words.

Related occupations

• Industrial Engineering Technologists and Technicians

• Robotics Engineers

• Marine Engineers and Naval Architects

• Mechanical Engineers

• Chemical Engineers

• Electrical and Electronic Engineering Technologists and Technicians

• Photonics Engineers

• Electronics Engineers, Except Computer

• Industrial Engineers

• Logistics Engineers

3.2.3 (3.8) Marketing Engineer

Job Duty

Description: what do they do?

Plan, direct, or coordinate marketing policies and programs, such as determining the demand for products and services offered by a firm and its competitors, and identify potential customers. Develop pricing strategies with the goal of maximizing the firm's profits or share of the market while ensuring the firm's customers are satisfied. Oversee product development or monitor trends that indicate the need for new products and services. Advertising, assistant brand, associate brand, campaign, channel marketing, communications, community, content marketing,

database marketing, digital marketing, email marketing, marketing analyst, online marketing, product analyst, product marketing, social media marketing, search engine marketing (SEM), marketing strategist

Also known as:

Account Supervisor, Brand Engineer, Business Development Director, Business Development Engineer, Commercial Lines Engineer, Market Development Executive, Marketing Coordinator, Marketing Director, Marketing Engineer, Product Engineer

Programs that can prepare you:

- Apparel and Textile Marketing Management
- Consumer Merchandising/Retailing Management
- Digital Marketing
- Hospitality and Recreation Marketing Operations
- International Marketing • Marketing Research
- Marketing, Other
- Marketing/Marketing Management, General
- Pharmaceutical Marketing and Management

Activities: what you might do in a day

- Develop marketing plans or strategies.
- Evaluate program effectiveness.
- Direct sales, marketing, or customer service activities.
- Estimate cost or material requirements.
- Analyze data to inform operational decisions or activities.
- Determine pricing or monetary policies.
- Compile operational data.
- Supervise employees.

• Confer with organizational members to accomplish work activities.

• Monitor external affairs or events affecting business operations.

• Analyze market research data.

• Analyze forecasting data to improve business decisions.

• Negotiate contracts for transportation, distribution, or logistics services.

• Coordinate special events or programs.

• Conduct opinion surveys or needs assessments.

• Develop sustainable organizational policies or practices.

• Recommend organizational process or policy changes.

• Advise others on business or operational matters.

• Develop marketing plans or strategies for environmental initiatives.

Knowledge

People in this career often know a lot about:

• Sales and Marketing - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Communications and Media - Knowledge of media production, communication, and dissemination techniques and methods. This includes

alternative ways to inform and entertain via written, oral, and visual media.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

Skills

People in this career often have these skills:

- Active Learning - Figuring out how to use new ideas or things.
- Active Listening - Listening to others, not interrupting, and asking good questions.
- Speaking - Talking to others.
- Social Perceptiveness - Understanding people's reactions.
- Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.
- Reading Comprehension - Reading work-related information.
- Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.
- Persuasion - Talking people into changing their minds or their behavior.
- Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.
- Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.
- Negotiation - Bringing people together to solve differences.
- Systems Evaluation - Measuring how well a system is working and how to improve it.
- Time Management - Managing your time and the time of other people.
- Coordination - Changing what is done based on other people's actions.
- Operations Analysis - Figuring out what a product or service needs to be able to do.
- Management of Personnel Resources - Selecting and managing the best workers for a job.

Abilities

People in this career often have talent in:

- Oral Comprehension - Listening and understanding what people say.
- Written Comprehension - Reading and understanding what is written.
- Oral Expression - Communicating by speaking.
- Written Expression - Communicating by writing.

- Deductive Reasoning - Using rules to solve problems.
- Speech Clarity - Speaking clearly.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Fluency of Ideas - Coming up with lots of ideas.

• Problem Sensitivity - Noticing when problems happen.

• Speech Recognition - Recognizing spoken words.

• Originality - Creating new and original ideas.

• Near Vision - Seeing details up close.

Related occupations

• Sales Engineers

• Market Research Analysts and Marketing Specialists

• Advertising and Promotions Engineers

• Management Analysts

• Public Relations Specialists

• Purchasing Engineers

• Training and Development Specialists

• Training and Development Engineers

• Human Resources Engineers

3.2.3 (3.9) Office Engineer, Administrative Services Engineer

Job Duty

Description: what do they do?

Plan, direct, or coordinate one or more administrative services of an organization, such as records and information management, mail distribution, and other office support services. Office, business, district, front office, operation, program coordinator, project coordinator, managing, procurement, purchasing, health, safety, human resource, checking, examining, recording, planning, organizing, networking.

Also known as:

Administrative Coordinator, Administrative Director, Administrative Manager, Administrative Officer, Administrator, Business Administrator, Business Manager

Programs that can prepare you:

- Business Administration and Management, General
- Business/Commerce, General
- Customer Service Management
- Medical/Health Management and Clinical Assistant/Specialist
- Office Management and Supervision
- Purchasing, Procurement/Acquisitions and Contracts Management
- Veterinary Office Management/Administration

Activities: what you might do in a day

- Prepare operational budgets.
- Hire personnel.
- Direct administrative or support services.
- Prepare operational progress or status reports.
- Develop organizational goals or objectives.
- Manage inventories of products or organizational resources.
- Purchase materials, equipment, or other resources.
- Recommend organizational process or policy changes.
- Analyze data to inform operational decisions or activities.
- Conduct employee training programs.

Knowledge

People in this career often know a lot about:

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Administrative - Knowledge of administrative and office procedures and systems such as word processing, managing files and records, stenography and transcription, designing forms, and workplace terminology.

Skills

People in this career often have these skills:

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Reading Comprehension - Reading work-related information.

• Time Management - Managing your time and the time of other people.

• Speaking - Talking to others.

• Writing - Writing things for co-workers or customers.

• Coordination - Changing what is done based on other people's actions.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Negotiation - Bringing people together to solve differences.

• Management of Personnel Resources - Selecting and managing the best workers for a job.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

Abilities

People in this career often have talent in:

• Written Comprehension - Reading and understanding what is written.

• Oral Comprehension - Listening and understanding what people say.

• Oral Expression - Communicating by speaking.

• Written Expression - Communicating by writing.

• Speech Clarity - Speaking clearly.

• Near Vision - Seeing details up close.

• Speech Recognition - Recognizing spoken words.

• Deductive Reasoning - Using rules to solve problems.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Problem Sensitivity - Noticing when problems happen.

Related occupations

• First-Line Supervisors of Office and Administrative Support Workers

• Property, Real Estate, and Community Association Managers

• Procurement Clerks

• Gambling Managers

• Wholesale and Retail Buyers, Except Farm Products

• General and Operations Managers

• Executive Secretaries and Executive Administrative Assistants

• Loan Officers

• Human Resources Specialists

• Claims Adjusters, Examiners, and Investigators

3.2.3 (3.10) Product Sales Engineer, Sales Engineer, Technical Sales Engineer

Job Duty

Description: what do they do?

Sell business goods or services, the selling of which requires a technical background equivalent to a baccalaureate degree in engineering. Inside sales, national sales, regional sales, Business development, engagement, sales account, strategic account, territory sales, wholesale account, field sales, online territory, relationship, tele sales, sales and marketing.

Also known as:

Product Sales Engineer, Sales Engineer, Technical Sales Engineer

Activities: what you might do in a day

• Share sales-related or market information with colleagues.

• Sell products or services.

• Implement design or process improvements.

• Gather customer or product information to determine customer needs.

• Discuss design or technical features of products or services with technical personnel.

• Develop content for sales presentations or other materials.

• Deliver promotional presentations to current or prospective customers.

• Explain technical product or service information to customers.

• Contact current or potential customers to promote products or services.

• Prepare sales or other contracts.

• Arrange delivery of goods or services.

• Develop proposals for current or prospective customers.

• Demonstrate products to consumers.

• Identify potential customers.

• Advise customers on the use of products or services.

• Explain financial information to customers.

• Recommend products or services to customers.

• Develop marketing plans or strategies.

• Troubleshoot equipment or systems operation problems.

• Maintain records of sales or other business transactions.

• Monitor market conditions or trends.

• Prepare financial documents, reports, or budgets.

• Prepare technical or operational reports.

• Attend events to develop professional knowledge.

• Train sales personnel.

Knowledge

People in this career often know a lot about:

• Sales and Marketing - Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

Skills

People in this career often have these skills:

• Persuasion - Talking people into changing their minds or their behavior.

• Reading Comprehension - Reading work-related information.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.
• Social Perceptiveness - Understanding people's reactions.

• Speaking - Talking to others.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Negotiation - Bringing people together to solve differences.

• Writing - Writing things for co-workers or customers.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Systems Analysis - Figuring out how a system should work and how changes in the future will affect it.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Time Management - Managing your time and the time of other people.

• Service Orientation - Looking for ways to help people.

• Systems Evaluation - Measuring how well a system is working and how to improve it.

• Active Learning - Figuring out how to use new ideas or things.

• Coordination - Changing what is done based on other people's actions.

• Instructing - Teaching people how to do something.

Abilities

People in this career often have talent in:

• Oral Comprehension - Listening and understanding what people say.

• Oral Expression - Communicating by speaking.

• Speech Recognition - Recognizing spoken words.

• Written Comprehension - Reading and understanding what is written.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Speech Clarity - Speaking clearly.

• Deductive Reasoning - Using rules to solve problems.

• Written Expression - Communicating by writing.

• Fluency of Ideas - Coming up with lots of ideas.

• Problem Sensitivity - Noticing when problems happen.

• Near Vision - Seeing details up close.

• Information Ordering - Ordering or arranging things.

• Category Flexibility - Grouping things in different ways.

• Originality - Creating new and original ideas.

Related occupations

- Logistics Engineers
- Energy Engineers, Except Wind and Solar
- Transportation Engineers
- Fire-Prevention and Protection Engineers
- Logistics Analysts
- Marine Engineers and Naval Architects
- Purchasing Managers
- Transportation, Storage, and Distribution Managers
- Industrial Engineers
- Purchasing Agents, Except Wholesale, Retail, and Farm Products

3.2.3 (3.11) Purchasing Engineer

Job Duty

Description: what do they do?

Plan, direct, or coordinate the activities of buyers, purchasing officers, and related workers involved in purchasing materials, products, and services. Includes

wholesale or retail trade merchandising Engineer and procurement Engineer.

Also known as:

Category Purchasing Manager, Commodity Manager, Materials Director, Materials Manager, Procurement Director, Procurement Manager, Purchasing Director, Purchasing Supervisor, Strategic Sourcing Director

Programs that can prepare you:

Purchasing, Procurement/Acquisitions and Contracts Management

Activities: what you might do in a day

- Negotiate sales or lease agreements for products or services.
- Analyze data to assess operational or project effectiveness.
- Prepare financial documents, reports, or budgets.
- Implement organizational process or policy changes.
- Develop organizational policies or programs.
- Develop operating strategies, plans, or procedures.
- Supervise employees.
- Interview employees, customers, or others to collect information.
- Coordinate with external parties to exchange information.
- Hire personnel.
- Conduct employee training programs.
- Prepare forms or applications.
- Prepare operational budgets.
- Examine financial records to ensure compliance with policies or regulations.
- Resolve employee or contractor problems.
- Direct financial operations.
- Maintain operational records.
- Analyze data to inform operational decisions or activities.
- Implement transportation changes to reduce environmental impact.
- Develop specifications for new products or processes.

• Schedule product or material transportation.

Knowledge

People in this career often know a lot about:

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Economics and Accounting - Knowledge of economic and accounting principles and practices, the financial markets, banking, and the analysis and reporting of financial data.

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

Skills

People in this career often have these skills:

• Social Perceptiveness - Understanding people's reactions.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Speaking - Talking to others.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Reading Comprehension - Reading work-related information.

• Writing - Writing things for co-workers or customers.

• Negotiation - Bringing people together to solve differences.

• Time Management - Managing your time and the time of other people.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Persuasion - Talking people into changing their minds or their behavior.

• Management of Personnel Resources - Selecting and managing the best workers for a job.

• Coordination - Changing what is done based on other people's actions.

• Service Orientation - Looking for ways to help people.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Active Learning - Figuring out how to use new ideas or things.

Abilities

People in this career often have talent in:

• Oral Comprehension - Listening and understanding what people say.

• Fluency of Ideas - Coming up with lots of ideas.

• Oral Expression - Communicating by speaking.

• Written Comprehension - Reading and understanding what is written.

• Originality - Creating new and original ideas.

• Speech Clarity - Speaking clearly.

• Written Expression - Communicating by writing.

• Speech Recognition - Recognizing spoken words.

• Problem Sensitivity - Noticing when problems happen.

• Deductive Reasoning - Using rules to solve problems.

• Information Ordering - Ordering or arranging things.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information. Related occupations

• Transportation, Storage, and Distribution Engineer

• Purchasing Agents, Except Wholesale, Retail, and Farm Products

• Supply Chain Engineer

• Logistics Analysts

• Marketing Engineer

3.2.3 (3.12) System Engineer

Job Duty

Manages and monitors all installed systems and infrastructure for the organization to be in line with company guidelines or SOP (standard operating procedure). Defines customers' needs and functionality in a service development cycle. Assists in the coordination of various teams testing and evaluating for the development of design and its implementation of the best output.

Installs, configures, and tests operating systems, application software, and system management tools.

Ensures the highest level of systems and infrastructure availability. Implements warranty and support activities. Evaluates the existing systems and provides the technical direction to IT support staff. Plans and implements system automation as required for better efficiency. Oversees the development of customized software and hardware requirement. Collaborates with other professionals to ensure high quality deliverables within organization guidelines, policies, and procedures.

Deals with work process, optimization methods, and risk management tools in the given projects for the successful accomplishments according to the requirements of the stakeholders.

• Demonstrated proficiency in analytical thinking, problem solving skills and Systems Thinking mindset

• Excellent decision making and communication (written and oral) skills

• Strong work ethic and the ability to work in an integrated product team (IPT) environment

• Must have ability to obtain Interim Secret clearance prior to start date. Once started, must have the ability to obtain full secret clearance and SAP (Special Access Program) clearance.

3.2.3 (3.13) Validation Engineer / Reliability Engineer / Product Quality Engineer

Job Duty

Description: What do they do?

Design or plan equipment or process protocols to produce products that meet internal and external purity, safety and quality requirements.

Also known as:

Corporate Quality Engineer, Product Quality Engineer, Quality Assurance Engineer, Quality Engineer, Quality Management Systems Engineer, Reliability Engineer, Supplier Quality Engineer, Validation Specialist.

Programs that can be prepared:

• Industrial Engineering and Management

• Industrial Engineering

• Manufacturing Industries Engineering

• The packaging of science

• Systems Engineering Activities: what can you do in a day?

• Review technical documents to plan work.

• Analyze validation or test data.

• Prepare detailed work plans.

• The technical design details of the document.

• Maintain the test equipment.

• Conduct validation tests of equipment or processes.

• Communicate technical information to suppliers, contractors, or regulatory agencies.

• Maintain operational records or records systems.

• Recommend technical design or process changes to improve efficiency, quality, or performance.

• Inspect finished products to locate flaws.

• Devise research or testing protocols.

• Resolve operational performance problems.

• Operate computer systems.

• Inspect operational processes.

• Collect samples of raw materials or finished products.

• Direct quality control activities.

• Update technical knowledge.

• Train personnel on proper operational procedures.

• Design electronic or computer equipment or instrumentation.

Knowledge:

People in this race often know a lot about:

• Engineering and Technology - Knowledge of the practical engineering application of science and technology. This includes the application of principles, techniques, procedures and equipment for the design and production of goods and services.

• Production and processing - Knowledge of raw materials, production processes, quality control, costs and other techniques to maximize the efficiency of manufacturing and distribution of goods.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Customer and Personal Service - Knowledge of the principles and processes for providing the client and personal services. This includes assessing customer needs, meeting service quality standards, and assessing customer satisfaction.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Design - Knowledge of design techniques, tools and principles involved in the production of precision of technical drawings, drawings, drawings and models.

Skills:

People in this career often have these skills:

• Reading comprehension - Information related to the reading job.

• Talking - Talking to others.

• Critical Thinking - Thinking about the pros and cons of different ways to solve un problem.

• Written - Write things for collaborators or clients.

• Surveillance - Keeping track of how people and/or groups are doing in order to make improvements.

• Active listening - others listen to a, not interrupting and asking good questions. • Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Science - The use of science rules and strategies to solve problems.

• Solving complex problems - Realizing a problem and figuring out the best way to solve it. Abilities: People in this career often have the talent in:

• Written Expression - Written communication.

• Deductive Reasoning - Use of rules to solve problems.

• Written comprehension - The reading and understanding of what is written.

• The problem of sensitivity - when this happens notice problems.

• Listening and understanding what they say.

• Oral expression - Communication for speaking.

• Oral Comprehension - Listening and understanding what people say.

• Inductive reasoning - Performing general rules or finding the answers to a lot of detailed information.

• Near vision - See the details closely.

• Greater clarity of voice - speaking clearly.

• Category flexibility - The grouping of things in different ways.

• Request for information - Orders and organize things.

• Speech recognition - The recognition of spoken words.

• Information Ordering - Ordering or arranging things.

3.2.3 (3.14) Construction Engineer

Job Duty

Description: what do they do?

Plan, direct, or coordinate, usually through subordinate supervisory personnel, activities concerned with the construction and maintenance of structures, facilities, and systems. Participate in the conceptual development of a construction project and oversee its organization, scheduling, budgeting, and implementation. Includes engineers in specialized construction fields, such as carpentry or plumbing. Assistant site, office, plant, checking, examining,

recording, planning, organizing, networking, coordinating, communication, procurement, purchasing, human resource 91

Also known as:

Concrete Foreman, Construction Area Engineer, Construction Foreman, Construction Engineer, Construction Services Engineer, Construction Superintendent, Job Superintendent

Programs that can prepare you:

- Business Administration and Management, General
- Business/Commerce, General
- Construction Engineering Technology/Technician
- Construction Management, General
- Construction Management, Other
- Construction Project Management
- Operations Management and Supervision
- Public Works Management

Activities: what you might do in a day

- Manage construction activities.
- Develop operating strategies, plans, or procedures.
- Prepare financial documents, reports, or budgets.
- Communicate organizational information to customers or other stakeholders.
- Communicate organizational policies and procedures.
- Supervise employees.
- Prepare forms or applications.
- Negotiate project specifications.
- Direct facility maintenance or repair activities.
- Review blueprints or other instructions to determine operational methods or sequences.
- Investigate industrial or transportation accidents.
- Determine operational compliance with regulations or standards.
- Develop procedures to evaluate organizational activities.

• Implement organizational process or policy changes.

• Purchase materials, equipment, or other resources.

• Estimate labor requirements.

• Evaluate green operations or programs for compliance with standards or regulations.

• Estimate green project costs.

• Analyze data to determine project feasibility.

• Develop environmental remediation or protection plans.

• Analyze forecasting data to improve business decisions.

• Model operational processes.

• Develop sustainable organizational policies or practices.

• Recruit personnel.

• Prepare operational budgets for green energy or other green operations.

• Train employees on environmental awareness, conservation, or safety topics.

Knowledge

People in this career often know a lot about:

• Building and Construction - Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Customer and Personal Service - Knowledge of principles and processes

for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Public Safety and Security - Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.

• Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

• Mechanical - Knowledge of machines and tools, including their designs, uses, repair, and maintenance.

Skills

People in this career often have these skills:

• Management of Personnel Resources - Selecting and managing the best workers for a job.

• Coordination - Changing what is done based on other people's actions.

• Time Management - Managing your time and the time of other people.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Speaking - Talking to others.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Reading Comprehension - Reading work-related information.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Active Learning - Figuring out how to use new ideas or things.

• Negotiation - Bringing people together to solve differences.

• Social Perceptiveness - Understanding people's reactions.

Abilities

People in this career often have talent in:

• Information Ordering - Ordering or arranging things.

• Problem Sensitivity - Noticing when problems happen.

• Oral Expression - Communicating by speaking.

• Visualization - Imagining how something will look after it is moved around or changed.

• Deductive Reasoning - Using rules to solve problems.

• Written Comprehension - Reading and understanding what is written.

• Oral Comprehension - Listening and understanding what people say.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Near Vision - Seeing details up close.

• Written Expression - Communicating by writing.

• Speech Clarity - Speaking clearly.

• Speech Recognition - Recognizing spoken words.

• Far Vision - Seeing details that are far away.

• Category Flexibility - Grouping things in different ways.

Related occupations

• Energy Engineers, Except Wind and Solar

• Fire-Prevention and Protection Engineers

• Civil Engineers

• Occupational Health and Safety Specialists

• Transportation Engineers

• Conservation Scientists

• Environmental Engineers

• Architectural and Engineering Engineers

• Transportation, Storage, and Distribution Engineers

• General and Operations Engineers

3.2.3 (3.15) Cost Engineer, Cost Estimator, Cost Consultant

Job Duty

Description: what do they do?

Prepare cost estimates for product manufacturing, construction projects, or services to aid management in bidding on or determining price of product or service. May specialize according to particular service performed or type of product manufactured.

Also known as:

Acquisition Cost Estimator, Construction Estimator, Cost Analyst, Cost Consultant, Cost Engineer, Cost Estimator, Estimator

Programs that can prepare you:

• Business Administration and Management, General

• Business/Commerce, General

• Construction Engineering

• Construction Engineering Technology/Technician

• Manufacturing Engineering

• Materials Engineering

• Mechanical Engineering

Activities: what you might do in a day

• Analyze business or financial data.

• Confer with personnel to coordinate business operations.

• Estimate costs of goods or services.

• Confer with others about financial matters.

• Monitor financial indicators.

• Assess the cost effectiveness of products, projects, or services.

• Prepare financial documents.

• Develop business or financial information systems.

• Establish business management methods.

• Negotiate agreements to resolve disputes.

• Maintain data in information systems or databases.

Knowledge

People in this career often know a lot about:

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Building and Construction - Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.

• Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

• Economics and Accounting - Knowledge of economic and accounting principles and practices, the financial markets, banking, and the analysis and reporting of financial data.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

Skills

People in this career often have these skills:

• Mathematics - Using math to solve problems.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Reading Comprehension - Reading work-related information.

• Speaking - Talking to others.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Writing - Writing things for co-workers or customers.

Abilities

People in this career often have talent in:

• Mathematical Reasoning - Choosing the right type of math to solve a problem.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Number Facility - Adding, subtracting, multiplying, or dividing.

• Oral Expression - Communicating by speaking.

• Oral Comprehension - Listening and understanding what people say.

• Deductive Reasoning - Using rules to solve problems.

• Written Comprehension - Reading and understanding what is written.

• Written Expression - Communicating by writing.

• Information Ordering - Ordering or arranging things.

• Speech Clarity - Speaking clearly.

• Near Vision - Seeing details up close.

Related occupations

• Logistics Analysts

• Purchasing Agents, Except Wholesale, Retail, and Farm Products

• Transportation, Storage, and Distribution Managers

• Market Research Analysts and Marketing Specialists

• Supply Chain Managers

• Regulatory Affairs Specialists

• Budget Analysts

• Transportation Planners

3.2.3 (3.16) Logistics Engineer, Reliability Engineer, Supportability Engineer, Systems Engineer

Job Duty

Description: what do they do?

Design or analyze operational solutions for projects such as transportation optimization, network modeling, process and methods analysis, cost containment, capacity enhancement, routing and shipment optimization, or information management.

Also known as:

Acquisition Logistics Engineer, Logistics Engineer, Reliability Engineer, Supportability Engineer, Systems Engineer

Programs that can prepare you:

- Business Administration and Management, General
- Logistics, Materials, and Supply Chain Management
- Operations Management and Supervision

Activities: what you might do in a day

- Advise others on logistics topics.
- Develop business or financial information systems.
- Analyze logistics processes.
- Identify opportunities to improve operational efficiency.
- Develop business or market strategies.
- Estimate costs of goods or services.
- Supervise employees.
- Develop technical specifications for systems or equipment.
- Establish organizational guidelines or policies.
- Analyze environmental regulations to ensure organizational compliance.
- Apply mathematical models of financial or business conditions.
- Maintain data in information systems or databases.
- Analyze jobs using observation, survey, or interview techniques.
- Evaluate logistics methods to reduce environmental impact.
- Plan facility layouts or designs.
- Assess the cost effectiveness of products, projects, or services.
- Prepare financial documents.

• Develop sustainable business strategies or practices.

Knowledge

People in this career often know a lot about:

• Engineering and Technology - Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

• Transportation - Knowledge of principles and methods for moving people

or goods by air, rail, sea, or road, including the relative costs and benefits.

• Design - Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

• Computers and Electronics - Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

Skills

People in this career often have these skills:

• Systems Analysis - Figuring out how a system should work and how changes in the future will affect it.

• Reading Comprehension - Reading work-related information.

• Writing - Writing things for co-workers or customers.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Mathematics - Using math to solve problems.

• Systems Evaluation - Measuring how well a system is working and how to improve it.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Active Learning - Figuring out how to use new ideas or things.

• Speaking - Talking to others.

• Time Management - Managing your time and the time of other people.

• Coordination - Changing what is done based on other people's actions.

• Operations Analysis - Figuring out what a product or service needs to be able to do.

Abilities

People in this career often have talent in:

• Written Comprehension - Reading and understanding what is written.

• Written Expression - Communicating by writing.

• Problem Sensitivity - Noticing when problems happen.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Oral Expression - Communicating by speaking.

• Oral Comprehension - Listening and understanding what people say.

• Deductive Reasoning - Using rules to solve problems.

• Fluency of Ideas - Coming up with lots of ideas.

• Mathematical Reasoning - Choosing the right type of math to solve a problem.

• Information Ordering - Ordering or arranging things.

• Speech Clarity - Speaking clearly.

• Number Facility - Adding, subtracting, multiplying, or dividing.

• Near Vision - Seeing details up close.

• Speech Recognition - Recognizing spoken words. Related occupations

• Logistics Analysts

• Energy Engineers, Except Wind and Solar

• Fire-Prevention and Protection Engineers

• Electrical Engineers

• Electronics Engineers, Except Computer

• Transportation Engineers

• Mining and Geological Engineers, Including Mining Safety Engineers

• Transportation, Storage, and Distribution Managers

• Sales Engineers

• Industrial Engineers

3.2.3 (3.17) Supply Chain Engineer, Solution Design and Analysis Engineer

Job Duty

Description: what do they do?

Direct or coordinate production, purchasing, warehousing, distribution, or financial forecasting services or activities to limit costs and improve accuracy, customer service, or safety. Examine existing procedures or opportunities for streamlining activities to meet product distribution needs. Direct the movement, storage, or processing of inventory. Logistic, E-commerce, inventory, material, procurement, purchasing, shipping, sourcing supply chain, transportation, vendor, warehouse

Also known as:

Global Supply Chain Engineer, Material Requirements Planning Engineer, Solution Design and Analysis Engineer, Supply Chain Engineer, Supply Chain Engineer

Programs that can prepare you:

• Aeronautics/Aviation/Aerospace Science and Technology, General

- Aviation/Airway Management and Operations
- Business Administration and Management, General
- Business/Commerce, General
- Logistics, Materials, and Supply Chain Management
- Public Administration
- Transportation and Infrastructure Planning/Studies
- Transportation/Mobility Management

Activities:

what you might do in a day

- Estimate cost or material requirements.
- Estimate labor requirements.
- Manage inventories of products or organizational resources.
- Implement transportation changes to reduce environmental impact.
- Develop organizational goals or objectives.
- Manage operations, research, or logistics projects.
- Develop procedures to evaluate organizational activities.
- Develop operating strategies, plans, or procedures.
- Confer with organizational members to accomplish work activities.
- Analyze data to inform operational decisions or activities.
- Negotiate contracts for transportation, distribution, or logistics services.
- Analyze data to assess operational or project effectiveness.
- Develop organizational methods or procedures.
- Coordinate with external parties to exchange information.
- Monitor performance of organizational members or partners.
- Implement organizational process or policy changes.
- Monitor external affairs or events affecting business operations.
- Develop sustainable organizational policies or practices.

• Document organizational or operational procedures.

• Evaluate quality of materials or products.

• Identify opportunities for green initiatives.

• Evaluate potential of products, technologies, or resources.

• Evaluate environmental impact of operational or development activities.

Knowledge

People in this career often know a lot about:

• Transportation - Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including the relative costs and benefits.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Economics and Accounting - Knowledge of economic and accounting principles and practices, the financial markets, banking, and the analysis and reporting of financial data.

• Customer and Personal Service - Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

• Production and Processing - Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

• Personnel and Human Resources - Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labor relations and negotiation, and personnel information systems.

• Mathematics - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

Skills

People in this career often have these skills:

• Reading Comprehension - Reading work-related information.

• Coordination - Changing what is done based on other people's actions.

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Monitoring - Keeping track of how well people and/or groups are doing in order to make improvements.

• Speaking - Talking to others.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Time Management - Managing your time and the time of other people.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Writing - Writing things for co-workers or customers.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Systems Evaluation - Measuring how well a system is working and how to improve it.

• Systems Analysis - Figuring out how a system should work and how changes in the future will affect it.

• Negotiation - Bringing people together to solve differences.

• Social Perceptiveness - Understanding people's reactions.

• Active Learning - Figuring out how to use new ideas or things.

• Management of Material Resources - Managing equipment and materials.

• Persuasion - Talking people into changing their minds or their behavior.

Abilities

People in this career often have talent in:

• Oral Expression - Communicating by speaking.

• Written Comprehension - Reading and understanding what is written.

• Written Expression - Communicating by writing.

• Oral Comprehension - Listening and understanding what people say.

• Problem Sensitivity - Noticing when problems happen.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Deductive Reasoning - Using rules to solve problems.

• Information Ordering - Ordering or arranging things.

• Speech Clarity - Speaking clearly.

• Category Flexibility - Grouping things in different ways.

• Near Vision - Seeing details up close.

• Speech Recognition - Recognizing spoken words. Related occupations

• Transportation, Storage, and Distribution Engineers

• Purchasing Engineers

• Purchasing Agents, Except Wholesale, Retail, and Farm Products

• Logistics Analysts

• Accountants and Auditors

• Logisticians

• First-Line Supervisors of Non-Retail Sales Workers

3.2.3 (3.18) Smart City and Infrastructure Engineers / Urban and Regional Engineers

Job Duty

Description: what do they do?

Develop comprehensive plans and programs for use of land and physical facilities of jurisdictions, such as towns, cities, counties, and metropolitan areas. Collect and analyze information and initial plans developed by the municipality related to their vision/conceptualization of Smart City concepts. Analyze the municipality's governance and planning capacities (Municipal Development Plans, Urban Plans, Operational Plans, among others).

Analyze the status and potential of municipal services that could be improved using Smart City technologies/concepts, identifying the critical challenges and opportunities for moving forward with the implementation of a Smart City Action Plan. Identify synergies and strategic alliances with the public and private sectors (local, national and foreign) that could be harnessed in support of the transformation of the municipality into a Smart City.

Identify viable technological solutions for the territory to respond to the problems or opportunities identified. Develop an action plan for transforming the municipality into a Smart City to improve the efficiency of municipal management and promote local economic development in a systematic and sustainable way. Identify short, medium and long-term actions (and investment plans) for the municipality to facilitate its transformation, along with clear implementation methodologies, indicators and timelines. Identify a portfolio of potential investment projects and potential resources for financing.

Also known as:

City Planner, Community Development Planner, Community Planner, Development Technician, Housing Development Specialist, Neighborhood Planner, Planner, Planning Consultant, Planning Technician, Regional Planner

Programs that can prepare you:

- City/Urban, Community, and Regional Planning
- Design for Human Health
- Real Estate Development
- Sustainability Studies
- Sustainable Design/Architecture
- Transportation and Infrastructure Planning/Studies
- Urban Studies/Affairs

Activities:

what you might do in a day

- Inform the public about policies, services or procedures.

• Design civil structures or systems.

• Advise others on business or operational matters.

• Prepare scientific or technical reports or presentations.

• Communicate with the public on environmental issues.

• Mediate disputes.

• Research impacts of environmental conservation initiatives.

• Review plans or proposals for environmental conservation.

• Communicate with government agencies.

• Review professional literature to maintain professional knowledge.

• Analyze impact of legal or regulatory changes.

• Review environmental permits, plans, or reports.

• Supervise scientific or technical personnel.

• Develop environmental sustainability plans or projects.

• Collaborate with technical specialists to resolve design or development problems.

• Promote environmental sustainability or conservation initiatives.

• Obtain property information.

Knowledge

People in this career often know a lot about:

• Law and Government - Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process.

• English Language - Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

• Geography - Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.

• Transportation - Knowledge of principles and methods for moving people or goods by air, rail, sea, or road, including the relative costs and benefits.

• Communications and Media - Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media.

• Administration and Management - Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

• Sociology and Anthropology - Knowledge of group behavior and dynamics, societal trends and influences, human migrations, ethnicity, cultures, and their history and origins.

Skills

People in this career often have these skills:

• Judgment and Decision Making - Thinking about the pros and cons of different options and picking the best one.

• Active Listening - Listening to others, not interrupting, and asking good questions.

• Speaking - Talking to others.

• Reading Comprehension - Reading work-related information.

• Critical Thinking - Thinking about the pros and cons of different ways to solve a problem.

• Systems Analysis - Figuring out how a system should work and how changes in the future will affect it.

• Writing - Writing things for co-workers or customers.

• Complex Problem Solving - Noticing a problem and figuring out the best way to solve it.

• Systems Evaluation - Measuring how well a system is working and how to improve it.

• Social Perceptiveness - Understanding people's reactions.

• Negotiation - Bringing people together to solve differences.

Abilities

People in this career often have talent in:

• Oral Expression - Communicating by speaking.

• Oral Comprehension - Listening and understanding what people say.

• Written Comprehension - Reading and understanding what is written.

• Problem Sensitivity - Noticing when problems happen.

• Written Expression - Communicating by writing.

• Speech Clarity - Speaking clearly.

• Inductive Reasoning - Making general rules or coming up with answers from lots of detailed information.

• Near Vision - Seeing details up close.

• Speech Recognition - Recognizing spoken words.

• Deductive Reasoning - Using rules to solve problems.

• Information Ordering - Ordering or arranging things.

• Fluency of Ideas - Coming up with lots of ideas.

• Category Flexibility - Grouping things in different ways.

Related occupations

• Transportation Planners

• Geographers

• Geographic Information Systems Technologists and Technicians

• Remote Sensing Scientists and Technologists

• Logistics Analysts

• Geography Teachers, Postsecondary

• Architects, Except Landscape and Naval

• Architectural and Engineering Managers

• Transportation, Storage, and Distribution Managers

3.2.4 Professional of Engineering Management and Entrepreneurship]

Professional of Engineering Management and Entrepreneurship" encompasses the integration of engineering principles, managerial skills, and entrepreneurial mindset. Practitioners in this field excel in overseeing engineering projects, optimizing resources, and identifying

entrepreneurial opportunities. They navigate project management, supply chain dynamics, quality control, and industrial optimization while considering economic engineering aspects. Overall, it involves blending technical expertise with strategic vision, fostering innovation, and contributing to the success of engineering ventures.

Automation: This involves the integration of technologies such as robotics and artificial intelligence to streamline and enhance processes, reducing the need for manual intervention and improving efficiency.

Economics Engineering: It's about applying economic principles to engineering decision-making. This includes considering factors like cost-effectiveness, resource allocation, and economic feasibility in engineering projects.

Ergonomics & Human Factor: Ergonomics focuses on designing systems and products that fit the human body and its cognitive abilities. Considering the human factor ensures that technology and processes are user-friendly and consider human limitations.

Supply Chain Management: This encompasses the end-to-end coordination of all processes involved in producing and delivering products to consumers,

optimizing efficiency and minimizing costs.

Maintenance: Maintenance involves activities to ensure that equipment, machinery, and systems are regularly serviced and repaired to prevent breakdowns, ensuring continuous operation.

Industrial Optimization: This field seeks to maximize efficiency and effectiveness in industrial processes. It involves analyzing workflows, identifying bottlenecks, and implementing improvements for optimal performance.

Production Management: This entails planning and overseeing manufacturing processes to ensure that goods are produced efficiently, meeting quality standards and delivery timelines.

Project Management: Project management involves initiating, planning, executing, and closing projects effectively. It ensures that projects are completed on time, within scope, and within budget.

Quality Control: Quality control focuses on maintaining and improving the quality of products. This involves monitoring and testing processes to ensure that products meet or exceed predefined standards.

Marketing: In the context of Engineering Management and Entrepreneurship, marketing involves strategies for promoting engineering products or services, understanding market needs, and positioning offerings effectively.

Activities: This encompasses various tasks involved in managing engineering projects and business operations. It includes planning, organizing, and overseeing day-to-day activities to ensure smooth and efficient operations.

3.2.5 SPSS Program

In analyzing data using statistics, if the dataset is small, calculations can be done manually or with small calculators. However, in reality, research involves large datasets, and using small calculators can be time-consuming, labor-intensive, and prone to errors. Therefore, the assistance of artificial intelligence or computers becomes essential for data analysis. Computer usage not only saves time and labor but also significantly reduces costs while ensuring high accuracy.

Researchers generally prefer using pre-built statistical software rather than writing their own programs. This is because learning to use such software is quick, eliminating the need to spend time on programming. In the early stages, pre-built programs like Lotus 1-2-3 were used for basic statistical analysis, creating visually appealing charts and graphs. As research progressed to advanced statistical analysis, dedicated programs such as SAS, MINITAB, SP, ISP, and SPSS/PC+ were developed. While these statistical programs excel in analysis, they may fall short in creating aesthetically pleasing charts and graphs. To bridge this gap, there's a reliance on a combination of these two types of programs.

Subsequently, there has been the development of comprehensive pre-built programs capable of advanced statistical analysis and diverse, beautiful chart and graph creation. One such program is SPSS for Windows.

Preparing Tools for Data Collection

The process of collecting data may involve using various tools such as tests, surveys, checklists, interviews, and observations. Researchers should prepare these tools to facilitate data analysis with computers, following these steps:

3.2.6 (1) Creating Codes and Variable Naming

Example: Questionnaire

Part 1 For officials

1. Gender[ ] 1. Man [ ] 2. Woman [ ] [ ] ID
2. Age_____ Year [ ] SEX
3. Year [ ] 1.Year 1 [ ] [ ] AGE
   [ ] 2.Year 2 [ ] YEAR
   [ ] 3.Year 3 and above
4. Condition [ ] 1. Regular section [ ] 2. Special section [ ] STATUS

From the example, the variable "ID" represents the questionnaire sequence number. There are two slots, indicating that only a two-digit number is needed if our sample group is less than a hundred people. If it exceeds a hundred people, then three digits are required.

In item 1, the variable named "SEX" has only one slot because it uses the number 1 for males and 2 for females only.

In item 2, the variable named "AGE" has two slots, representing the age of the sample group, using only two digits.

In item 3, the variable named "YEAR" has one slot representing the option number: 1 for year 1, 2 for year 2, and 3 for year 3 and above.

In item 4, the variable named "STATUS" has one slot representing the option number: 1 for normal status and 2 for special status.

Example of Coding for Questionnaire 1

On the left side, questions 1 to 4 are for respondents, while on the right side, there is coding following the researcher's coding manual.

Part 1 For officials

1. Gender [/] 1. Man [ ] 2. Woman [0] [1] ID 1 - 2
2. Age__28__ Year [1] SEX 4
3. Year [ ] 1.Year 1 [2] [8] AGE 6 - 7
   [/] 2.Year 2 [2] YEAR 9
   [ ] 3.Year 3 and above
4. Condition [/] 1. Regular section [ ] 2. Special section [1] STATUS 11

Example of Coding for Questionnaire 2

Place a checkmark (X) in front of the countries you would like to visit. (Multiple answers are allowed.)

[ ] 1. Chinese [ ] COUNTRY1 15

[ ] 2. English [ ] COUNTRY2 16

[ ] 3. America [ ] COUNTRY3 17

[ ] 4. French [ ] COUNTRY4 18

From this example, it is evident that respondents can choose more than one option. Therefore, the coding assigns the number 1 to represent a respondent's selection of that option, and 0 to represent a respondent not choosing that option.

[X] 1. Chinese [1] COUNTRY1 15

[X] 2. English [1] COUNTRY2 16

[ ] 3. America [0] COUNTRY3 17

[X] 4. French [1] COUNTRY4 18

Example of Coding for Questionnaire 3

Please rank the countries you would like to visit, with the country you most want to visit as number 1, followed by your second, third, and fourth choices.

[ ] 1. Chinese [ ] COUNTRY1 15

[ ] 2. English [ ] COUNTRY2 16

[ ] 3. America [ ] COUNTRY3 17

[ ] 4. French [ ] COUNTRY4 18

From the example, there are two possible coding methods:

Format 1 uses the number at the front of the question as a code for the data, as shown in the response example.

[2] 1. Chinese [3] COUNTRY1 15

[4] 2. English [1] COUNTRY2 16

[1] 3. America [4] COUNTRY3 17

[3] 4. French [2] COUNTRY4 18

The respondent chose America as the first choice, so the number 3 is entered in the variable COUNTRY 1, which corresponds to option 3.

The respondent chose China as the second choice, so the number 1 is entered in the variable COUNTRY 2, corresponding to option 1.

The respondent chose France as the third choice, so the number 4 is entered in the variable COUNTRY 3, corresponding to option 4.

The respondent chose England as the fourth choice, so the number 2 is entered in the variable COUNTRY 4, corresponding to option 2.

Format 2 uses the selected order as a code for the data, as illustrated in the response example.

[2] 1. Chinese	[2] COUNTRY1 15
[4] 2. English	[4] COUNTRY2 16
[1] 3. America	[1] COUNTRY3 17
[3] 4. French	[3] COUNTRY4 18

The respondent chose China as the second choice, so the number 2 is entered in the variable COUNTRY 1, corresponding to option 2.

The respondent chose England as the fourth choice, so the number 4 is entered in the variable COUNTRY 2, corresponding to option 4.

The respondent chose America as the first choice, so the number 1 is entered in the variable COUNTRY 3, corresponding to option 1.

The respondent chose France as the third choice, so the number 3 is entered in the variable COUNTRY 4.

3.2.6 (2) Creating a Coding Manual

Example Questionnaire

For officials

1) Gender [ ] 1. Man [ ] 2. Woman [ ] [ ] ID
2) Age_____ Year [ ] SEX
3) Year [ ] 1.Year 1 [ ] [ ] AGE
[ ] 2.Year 2 [ ] YEAR
[ ] 3.Year 3 and above
4) Condition [ ] 1. Regular section [ ] 2. Special section [ ] STATUS

You can create an encoding manual as follows

No	Variables	List	Number of digits	Possible values
-	ID	ID	2	01 – 20
1	SEX	SEX	1	1. Man
				2. Woman
2	AGE	AGE	2	25 – 38 Year
3	YEAR	YEAR	1	1. Year 1
				2. Year 2
				3. Year 3 and above
4	STATUS	STATUS	1	1. Regular section
				2. Special section

Table 3.1 Table of Creating a Coding Manual

Data Preparation for Analysis

Once data has been collected from the sample group using the tools, all the responses obtained need to be prepared before starting the data analysis process.

Suppose the collected responses are as follows:

Dataset 1

ID	SEX	AGE	YEAR	STATUS
01	1	28	2	1
02	2	35	3	2
03	1	29	1	1
04	1	32	1	1
05	2	34	2	1
06	1	28	3	2
07	2	25	3	2
08	1	32	2	1
09	2	33	2	1
10	2	38	2	2
11	2	38	2	2
12	2	29	1	1
13	1	28	3	2
14	1	34	2	1
15	2	32	1	2
16	1	26	3	1
17	2	27	3	1
18	2	36	3	2
19	1	32	1	1
20	2	33	1	2

Table 3.2 Table of Data Preparation for Analysis

3.2.7 Tool Testing

3.2.7 (1) Testing the reliability of the scale, which involves analyzing data using the Cronbach's Alpha coefficient method, a technique for measuring internal consistency within the same set, as shown in equation 3.1.

$$\text{Cronbach's Alpha} = \frac{\overline{kCovariance}/\overline{Variance}}{1+(k-1)\overline{Covariance}/\overline{variance}} \quad (3.1)$$

Where k = The number of questions

Covariance = The average of the variances between different questions

Variance = The average of the variances of questions

In the case of standardization, each item's Cronbach's Alpha coefficient will be transformed as shown in equation 3.2.

$$\text{Cronbach's Alpha} = \frac{\overline{kCovariance}/\overline{Variance}}{1+(k-1)\overline{Covariance}/\overline{variance}} \quad (3.2)$$

Where $\bar{r}$ = The average of the correlation coefficients between different items.

Chapter 4

Research Results

4.1 Introduction

From the previous chapter, after conducting data collection through online surveys sent to personnel involved with Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs. A total of 150 individuals were contacted, and 120 responses were received, constituting an 80% response rate as

Table 4.1 Show the number of questionnaires

Method	Total number (sets)	Returned or answered questionnaires		Not returned or unanswered questionnaires	
		(sets)	%	(sets)	%
• Creating an online questionnaire to be sent to personnel involved with Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs.	150	120	80	30	20

Then, the collected data were analyzed statistically, divided into parts as follows:

(1) Analysis of Survey Data Part 1: Personal data by calculating frequency and percentage.

(2) Analysis of Survey Data Part 2: Importance level of each factor used to assess competencies of desired graduates for careers in engineering management and entrepreneurship programs by comparing the importance level of each factor.

4.2 Analysis of Survey Data Part 1 : Personal Data

These questions were asked to perform an analysis by determining frequency and percentage. They aim to gather personal information of respondents and factors used to assess competencies of desired graduates for careers in engineering management and entrepreneurship programs, by comparing the importance level of each factor.

Question 1 Please indicate your characteristics as follows:

Question 1.1 Gender

Table 4.2 Show the gender of respondents.

Gender	Number (people)	Percentage
Male	75	62.5
Female	45	37.5
Total	120	100

From Table 4.2, it shows the gender of respondents, consisting of 75 males (62.5%) and 45 females (37.5%).

Question 1.2 Age

Table 4.3 Show the age of respondents.

Age	Number (people)	Percentage (%)
< 18	3	2.5
18 – 23	71	59.2
24 – 26	21	17.5
27 – 35	18	15
35 – 60	6	5
> 60	1	0.8
Total	120	100

From Table 4.3, it shows the ages of the respondents, consisting of: Less than 18 3 people (2.5%) 18 – 23 71 people (59.2%) 24 – 26 21 people (17.5%) 27 – 35 18 people (15%) 35 – 60 6 people (5%) and more than 60 1 person (0.8%)

Question 1.3 Education Qualifications

Table 4.4 Show the education qualifications of respondents.

Education Qualifications	Number (people)	Percentage (%)
High School	0	00.0
Bachelor's Degree	97	80.83
Master's Degree	21	17.50
Doctorate Degree	1	0.83
Others	1	0.83
Total	120	100

From Table 4.4, it shows the educational qualifications of respondents, including: High School 0 people (0.00%) Bachelor's Degree 97 people (80.8%) Master's Degree 21 people (17.5%) Doctorate Degree 1 person (0.8%) and Others 1 person (0.8%)

Question 1.4 Current Positions in the Organization

Question 1.5 Duration in Current Positions: years/months

Table 4.5 Show the current positions in the organization and duration of holding the current positions: years/months.

Current Positions	Number (people)	Percentage (%)	Duration in Current Positions: years/months
Community Relations	1	0.83	2 years 3 months
Cost Engineer	3	2.5	1 year 8 months
Design Engineer	6	5.00	2 years 6 months
Engineering Manager	5	4.17	3 years 4 months
Foreman	2	1.67	1 year 11 months
Human Resources Department	9	7.50	2 years 9 months
Improvement Engineer	2	1.67	3 years 2 months
Maintenance Engineer	4	3.33	4 years 7 months
Manager	5	4.17	1 year 5 months
Process Engineer	1	0.83	2 years 3 months
Production Control Engineer	2	1.67	1 year 8 months
Production Engineer	1	0.83	2 years 6 months

Table 4.5 (continued)

Current Positions	Number (people)	Percentage (%)	Duration in Current Positions: years/months
Production Planning Engineer	1	0.83	2 years 3 months
Project Engineer	14	11.67	1 year 8 months
Purchase Engineer	3	2.50	2 years 6 months
QA Engineer	2	1.67	3 years 4 months
R&D Engineer	1	0.83	1 year 11 months
Sales Engineer	12	10.00	2 years 9 months
Site Engineer	13	10.83	3 years 2 months
Supervisor	3	2.50	4 years 7 months
Supplier QA Engineer	4	3.33	1 year 5 months
Others	26	21.67	N/A
Total	120	100	

From table 4.5 shown current position of the organization and period of time for the tenure of the questionnaire which including 1 Production Planning Engineer (0.83%), 14 Project Engineer (11.67%), 3 Purchase Engineer (2.50%), 2 QA Engineer (1.67%), 1 R&D Engineer (0.83%), 12 Sales Engineer (10.00%), 13 Site Engineer (10.83%), 3 Supervisor (2.50%), 4 Supplier QA Engineer (3.33%) and 26 person on other position (21.67%)

Question 1.6 Your current duties are related to

❍ Foreman
❍ Design
❍ Accounting and Finance
❍ Research and Development
❍ Others.....
❍ Organizational/Business Management
❍ Project Management
❍ Human Resources
❍ Sales

Table 4.6 Show what your current duties are related to

Your current duties are related to	Number (people)	Percentage (%)
Foreman	4	3.33
Junior Engineer	13	10.8
Project Engineer	4	3.33
Site Engineer	9	7.5
Senior Civil Engineer	9	7.5
Student	14	11.7
Design	3	2.5
Accounting and Finance	3	2.5
Research and Development	2	1.7
Organizational/Business Management	3	2.5
Project Management	5	4.2
Human Resources	5	4.2
Sales	1	0.8
Others	45	37.44

From Table 4.6, Your current duties are related to of the respondents consists of Foreman 4 people (3.33%), Junior Engineer 13 people (10.8%), Project Engineer 4 people (3.33%), Site Engineer 9 people (7.5%). , Senior Civil Engineer 9 people (7.5%), Student 14 people (11.7%), Design 3 people (2.5%), Accounting and Finance 3 people (2.5%), Research and Development 2 people, Organizational/Business Management 3 people (2.5%), Project Management 5 people (4.2%), Human Resources 5 people (4.2%), Sales 1 person (0.8%) and Others 45 people (37.44%).

Question 2 Could you please provide the specifications of your organization?

Question 2.1 Total duration since the organization was established.

From the survey, the organizational tenure of the respondents ranges from a minimum of 8 years to a maximum of 106 years. On average, the organizational tenure is 21.50 years.

4.3 Analysis of the Survey Part 2

Table 4.7 Shows the importance level and ranking of List of job in Engineering Management and Entrepreneurship field

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
List of job in Engineering Management and Entrepreneurship field					
1) Engineering Entrepreneur	13	28	75	3	1
2) Business Development Engineer	11	69	38	2	0
3) Engineering Management Analysts, Engineering Management Consultant	15	50	52	3	0
4) Facilities Engineer / Operations Engineer / Research and Development Engineer	12	59	44	4	0
5) General and Operations Engineer, Business Engineer, Store Engineer	11	54	52	3	0
6) Human Factors Engineer, Ergonomists, Cognitive Engineer	8	62	46	4	0

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
List of job in Engineering Management and Entrepreneurship field					
7) Manufacturing Engineers / Plant Engineer / Process Engineer	13	51	52	4	0
8) Manufacturing Engineers / Plant Engineer / Process Engineer	13	51	52	4	0
9) Marketing Engineer	15	55	45	5	0
10) Office Engineer, Administrative Services Engineer	11	57	48	4	0
11) Product Sales Engineer, Sales Engineer, Technical Sales Engineer	12	44	59	4	0
12) Purchasing Engineer	55	51	2	1	0
13) System Engineer	16	52	46	4	2
14) Validation Engineer / Reliability Engineer / Product Quality Engineer	16	58	40	5	0
15) Construction Engineer	21	50	47	1	1
16) Cost Engineer, Cost Estimator, Cost Consultant	16	56	43	4	0
17) Logistics Engineer, Reliability Engineer, Supportability Engineer, System Engineer	17	52	47	4	0
18) Supply Chain Engineer, Solution design and Analysis	16	57	44	3	0
19) Smart City and Infrastructure Engineer	15	52	44	5	4

Table 4.8 Shows the importance level and ranking of sub-factors

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 1 – Personal Effectiveness Competencies					
1) Interpersonal Skills	24	37	58	1	0
2) Initiative	22	75	22	0	0
3) Integrity & Perseverance	26	58	34	2	0
4) Professionalism	27	66	25	1	0
5) Adaptability, Resilience, Flexibility, Stress Tolerance	35	44	40	1	0
6) Dependability & Reliability	35	51	33	1	0
7) Lifelong Learning	36	50	34	0	0
Tier 2 – Academic Competencies					
1) Engineering Management	23	44	52	1	0
2) Writing	36	61	22	1	0
3) Mathematics	35	64	20	1	0
4) Science & Technology	38	53	27	2	0
5) Communication: Listening & Speaking	43	50	26	1	0
6) Critical & Analytical Thinking	41	59	19	1	0
7) Computer Skills	46	45	27	1	0
Tier 3 – Workplace Competencies					
1) Teamwork	47	48	25	0	0
2) Client/Stakeholder Focus	47	59	14	0	0
3) Planning & Organizing	49	55	16	0	0
4) Creative Thinking	56	47	17	0	0
5) Problem Solving Prevention & Decision Making	50	48	20	1	0
6) Seeking & Developing Opportunities	43	57	19	1	0
7) Working with Tools & Technology	47	53	19	1	0

Table 4.8 (continued)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 3 – Workplace Competencies					
8) Scheduling & Coordinating	43	58	18	0	0
9) Checking, Examining & Recording	51	46	21	1	0
10) Business Fundamentals	45	58	14	2	0
Tier 4 – Industry – Wide Technical Competencies					
1) Foundations of Engineering	19	61	39	1	0
2) Design	32	63	23	2	0
3) Manufacturing & Construction	25	69	23	2	0
4) Operations & Maintenance	31	65	22	2	0
5) Professional Ethics	24	68	22	0	0
6) Business, Legal & Public Policy	24	60	32	3	0
Tier 5 – Industry – Sector Functional Areas					
1) Smart City	15	37	48	16	4
2) Construction Engineering Management	31	51	34	3	1
3) Logistics and Supply Chain	20	55	39	5	0
4) System Engineering	22	54	33	8	3
Tier 6 – Professional in Engineering Management and Training					
1) Decision and Multi-Analysis	16	71	31	1	0
2) Strategic Management	16	72	29	3	0
3) Ergonomics & Human Factor	13	70	35	0	0
4) Economics Engineering	29	66	21	3	0
5) Engineering Management	16	66	36	1	0
6) Business Capital Assistance	17	65	36	2	0
7) Office Administration	20	69	29	1	0
8) Risk Management	20	60	37	2	0
9) Production and Operation Management	17	64	38	1	0

Table 4.8 (continued)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 6 – Professional in Engineering Management and Training					
10) Production Training	23	53	44	0	0
11) Production Process and Design	21	65	33	0	0
12) Quality Control	22	53	31	2	0
13) Project Management	27	51	41	1	0
14) External Collaboration	29	55	37	3	0

Table 4.9 Shows the importance level and ranking of Main-factors

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 1 – Personal Effectiveness Competencies					
1) Entrepreneurship & Startup	16	54	43	5	0
2) Digital quotient literacy & Digital media Production	27	62	28	2	0
3) Ambition	21	65	31	2	0
4) Leadership & Social Influence	21	68	28	1	0
5) Willingness to take Risks	22	58	38	1	0
6) Willingness to Lean	22	57	37	2	0
Tier 2 – Academic Competencies					
1) Reading	51	37	30	2	0
2) Writing	57	50	12	1	0
3) Mathematics	45	53	20	1	0
4) Science & Technology	48	50	21	0	0
5) Communication: Listening & Speaking	48	52	18	1	0

Table 4.9 (continued)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 2 – Academic Competencies					
6) Critical & Analytical Thinking	44	51	24	0	0
7) Small Business Development	20	55	43	2	0
8) Social Entrepreneurship	16	55	45	4	0
9) High-Growth, High Value Entrepreneurship	21	52	43	3	0
Tier 3 – Workplace Competencies					
1) Creative Thinking	30	54	36	0	0
2) Networking	35	66	19	0	0
3) Planning & Organizing	31	65	24	0	0
4) Problem Solving Prevention & Decision Making	28	56	33	1	0
5) Checking, Examining & Recording	29	58	31	2	0
6) Business Fundamentals	32	59	28	1	0
7) Computer Applications	33	51	36	0	0
8) Health & Safety	31	53	33	0	0
Tier 4 – Industry – Wide Technical Competencies					
1) Principles of Entrepreneurship	44	24	51	0	0
2) Innovation & Invention	24	50	45	0	0
3) Planning	20	50	45	2	2
4) Marketing	33	56	28	0	0
5) Financial Management	30	51	31	0	0
6) Business Operations	32	53	25	5	2
7) Risk Assessment & Management	37	45	28	4	2

Table 4.9 (continued)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 5 – Industry – Sector Functional Areas					
7) Youth Entrepreneurship	20	51	47	2	0
10) Micro-Enterprise	30	40	20	4	0
11) Small Business Development	20	55	43	2	0
12) Social Entrepreneurship	16	55	45	4	0
13) High-Growth, High Value Entrepreneurship	21	52	43	3	0
Tier 6 – Professional in Entrepreneurship and Training					
1) Global Awareness	18	70	29	2	0
2) Professional Training	23	58	37	2	0
3) Marketing Training	25	56	39	0	0
4) IT and Automation	17	50	50	2	0

4.3.1 The Importance Level of Key factors

Table 4.10 Show the List of job in Engineering Management and Entrepreneurship field by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
List of job in Engineering Management and Entrepreneurship field			
1) Business Development Engineer	22	29.39	1.33
2) Engineering Entrepreneur	24	26.92	1.12
3) Engineering Management Analysts, Engineering Management Consultant	21.8	23.5	1.05
4) Human Factors Engineer, Ergonomists, Cognitive Engineer	24	24.49	1.02
5) System Engineer	23	23.36	1.01
6) General and Operations Engineer, Business Engineer, Store Engineer	24	23.96	0.99
7) Manufacturing Engineers / Plant Engineer / Process Engineer	24	22.85	0.95
8) Logistics Engineer, Reliability Engineer, Supportability Engineer, System Engineer	23.8	21.76	0.91
9) Construction Engineer	24	21.92	0.91
10) Facilities Engineer / Operations Engineer / Research and Development Engineer	23.8	21.48	0.90
11) Supply Chain Engineer, Solution design and Analysis	23.2	20.30	0.88
12) Cost Engineer, Cost Estimator, Cost Consultant	23.8	20.83	0.88

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
List of job in Engineering Management and Entrepreneurship field			
13) Validation Engineer / Reliability Engineer / Product Quality Engineer	23.8	20.80	0.87
14) Marketing Engineer	24	20.88	0.87
15) Smart city and Infrastructure Engineer	24	20.64	0.86
16) Product Sales Engineer, Sales Engineer, Technical Sales Engineer	23.8	20.40	0.85
17) General and Operations Engineer, Business Engineer, Store Engineer	24	20.51	0.85
18) Office Engineer, Administrative Services Engineer	24	19.60	0.82

From Table 4.10, **Business Development Engineer** has maximum Measurement of importance level = **1.33**, Sub-factor **Engineering Entrepreneur** has the second value of Measurement of importance level **1.12**, Sub-factor **Engineering Management Analysts, Engineering Management Consultant** has the third value of Measurement of importance level **1.05**, The other sub-factor **Human Factors Engineer, Ergonomists, Cognitive Engineer, System Engineer and General and Operations Engineer, Business Engineer, Store Engineer** have the Measurement of importance level = **1.02, 1.01 and 0.99** respectively.

Table 4.11 Show the Engineering Management competencies tiers 1 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 1 – Personal Effectiveness Competencies			
1) Initiative	23.8	30.86	1.30
2) Interpersonal Skills	24.5	21.87	0.89
3) Professionalism	23.8	20.51	0.86
4) Integrity & Perseverance	28.0	21.13	0.75
5) Adaptability, Resilience, Flexibility, Stress Tolerance	32.8	17.20	0.52
6) Dependability & Reliability	24.0	9.70	0.40
7) Lifelong Learning	34.0	8.66	0.25

From Table 4.11, **Initiative** has maximum Measurement of importance level = **1.30**, Sub-factor **Interpersonal Skills** has the second value of Measurement of importance level **0.89**, Sub-factor **Professionalism** has the third value of Measurement of importance level **0.86**, The other sub-factor **Integrity & Perseverance, Adaptability, Resilience, Flexibility, Stress Tolerance and Dependability & Reliability** have the Measurement of importance level = **0.75, 0.52 and 0.40** respectively.

Table 4.12 Show the Engineering Management competencies tiers 2 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 2 – Academic Competencies			
1) Mathematics	36.8	21.42	0.58
2) Writing	36.2	17.30	0.48
3) Professionalism	28.4	13.27	0.47
4) Integrity & Perseverance	39.8	16.94	0.43
5) Science & Technology	35.0	10.10	0.29
6) Communication: Listening & Speaking	41.2	8.94	0.22
7) Computer Skills	44.8	8.59	0.19

From Table 4.12, **Mathematics** has maximum Measurement of importance level = **0.58**, Sub-factor **Writing** has the second value of Measurement of importance level **0.48**, Sub-factor **Professionalism** has the third value of Measurement of importance level **0.47**, The other sub-factor **Integrity & Perseverance, Science & Technology and Communication: Listening & Speaking** have the Measurement of importance level = **0.43, 0.29 and 0.22** respectively.

Table 4.13 Show the Engineering Management competencies tiers 3 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 3 – Workplace Competencies			
1) Client/Stakeholder Focus	36.0	20.12	0.56
2) Planning & Organizing	39.0	16.34	0.42
3) Creative Thinking	47.4	19.90	0.42
4) Business Fundamentals	43.8	16.65	0.38
5) Teamwork	33.6	11.99	0.36
6) Seeking & Developing Opportunities	44.0	14.46	0.33
7) Scheduling & Coordinating	43.4	14.35	0.33
8) Working with Tools & Technology	44.0	14.28	0.32
9) Checking, Examining & Recording	44.8	13.96	0.31
10) Problem Solving Prevention & Decision Making	43.8	11.49	0.26

From Table 4.13, **Client/Stakeholder Focus** has maximum Measurement of importance level = **0.56**, Sub-factor **Planning & Organizing** has the second value of Measurement of importance level **0.42**, Sub-factor **Creative Thinking** has the third value of Measurement of importance level **0.42**, The other sub-factor **Business Fundamentals, Teamwork and Seeking & Developing Opportunities** have the Measurement of importance level = **0.38, 0.36 and 0.33** respectively.

Table 4.14 Show the Engineering Management competencies tiers 4 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 4 – Industry – Wide Technical Competencies			
1) Manufacturing & Construction	28.0	21.24	0.76
2) Professional Ethics	26.8	19.34	0.72
3) Design	28.2	18.66	0.66
4) Operations & Maintenance	28.4	18.11	0.64
5) Business, Legal & Public Policy	27.8	16.91	0.61
6) Foundations of Engineering	27.6	16.20	0.59

From Table 4.14, **Manufacturing & Construction** has maximum Measurement of importance level = **0.76**, Sub-factor **Professional Ethics** has the second value of Measurement of importance level **0.72**, Sub-factor **Design** has the third value of Measurement of importance level **0.66**, The other sub-factor **Operations & Maintenance, Business, Legal & Public Policy and Foundations of Engineering** have the Measurement of importance level = **0.64, 0.61 and 0.59** respectively.

Table 4.15 Show the Engineering Management competencies tiers 5 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 5 – Industry – Sector Functional Areas			
1) Logistics and Supply Chain	23.8	16.80	0.71
2) System Engineering	24.0	14.96	0.62
3) Smart City	24.0	13.79	0.57
4) Construction Engineering Management	36.0	13.19	0.37

From Table 4.15, **Logistics and Supply Chain** has maximum Measurement of importance level = **0.71**, Sub-factor **System Engineering** has the second value of Measurement of importance level **0.62**, Sub-factor **Smart City** has the third value of Measurement of importance level **0.57**, The other sub-factor **Construction Engineering Management** have the Measurement of importance level = **0.37** respectively.

Table 4.16 Show the Engineering Management and Training competencies tiers 6 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 6 – Professional in Engineering Management and Training			
1) Decision and Multi-Analysis	23.8	30.06	1.27
2) Strategic Management	24.0	30.26	1.26
3) Ergonomics & Human Factor	23.6	29.21	1.23
4) Economics Engineering	23.8	25.59	1.07
5) Engineering Management	23.8	22.58	0.95
6) Business Capital Assistance	24.0	22.29	0.92
7) Office Administration	22.4	20.61	0.92
8) Risk Management	23.8	20.20	0.84
9) Production and Operation Management	25.53	20.91	0.82
10) Production Training	24.0	19.6	0.81
11) Production Process and Design	23.8	18.44	0.77
12) Quality Control	22.0	13.19	0.59
13) Project Management	23.6	14.07	0.59
14) External Collaboration	24.8	14.47	0.58

From Table 4.16, **Decision and Multi-Analysis** has maximum Measurement of importance level = **1.27**, Sub-factor **Strategic Management** has the second value of Measurement of importance level **1.26**, Sub-factor **Ergonomics & Human Factor** has the third value of Measurement of importance level **1.23**, The other sub-factor **Economics Engineering, Engineering Management and Business Capital Assistance** have the Measurement of importance level = **1.07, 0.95 and 0.92** respectively.

From the analysis results in Table 4.11-4.16, it shows the Engineering Management competencies 6 Tiers comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.), and Measurement of importance level (Coefficient of Variation: CV). This displays the analysis of the $(\bar{x})$, S.D., and CV values of subfactors under each main factor Tier 1-6. The analysis results have been utilized to arrange the subfactors' importance levels from highest to lowest according to the Measurement of importance level (Coefficient of Variation: CV). The results are as shown in the table above, and they will be further summarized and discussed in Chapter 5. In addition, the obtained $(\bar{x})$ values of the main factors in Engineering Management competencies can be used to conduct hypothesis testing to measure the differences among the main factors, all six of them. For example, a hypothesis test can be formulated as follows:

H_0 : The means of the main factors in Engineering Management skills are not significantly different.

H_a : The means of the main factors in Engineering Management skills are significantly different.

or

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$

H_a: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5 \neq \mu_6$

Based on the hypotheses stated above, to test the differences among the main factors, this research has preliminarily outlined a framework. This framework serves as a guideline for future research endeavors.

Table 4.17 Show the Entrepreneurship competencies tiers 1 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 1 – Personal Effectiveness Competencies			
1) Entrepreneurship & Startup	21	17.20	0.92
2) Leadership & Social Influence	23.6	21.08	0.89
3) Ambition	23.8	29.21	0.86
4) Willingness to take Risks	23.4	19.17	0.82
5) Digital quotient literacy & Digital media Production	23.8	17.68	0.74
6) Willingness to Learn	23.6	17.2	0.72

From Table 4.17, **Entrepreneurship & Startup** has maximum Measurement of importance level = **0.92**, Sub-factor **Leadership & Social Influence** has the second value of Measurement of importance level **0.89**, Sub-factor **Ambition** has the third value of Measurement of importance level **0.86**, The other sub-factor **Willingness to take Risks, Digital quotient literacy & Digital media Production and Willingness to Learn** have the Measurement of importance level = **0.82, 0.74 and 0.72** respectively.

Table 4.18 Show the Entrepreneurship competencies tiers 2 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 2 – Academic Competencies			
1) Writing	24	20.59	0.86
2) Mathematics	23.8	16.18	0.68
3) Communication: Listening & Speaking	23.8	15.97	0.67
4) Science & Technology	23.8	15.29	0.64
5) Critical & Analytical Thinking	23.8	14.82	0.62
6) Reading	24.0	9.66	0.40

From Table 4.18, **Writing** has maximum Measurement of importance level = **0.86**, Sub-factor **Mathematics** has the second value of Measurement of importance level **0.68**, Sub-factor **Communication: Listening & Speaking** has the third value of Measurement of importance level **0.67**, The other sub-factor **Science & Technology, Critical & Analytical Thinking and Reading** have the Measurement of importance level = **0.64, 0.62 and 0.40** respectively.

Table 4.19 Show the Entrepreneurship competencies tiers 3 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 3 – Workplace Competencies			
1) Networking	24.0	20.82	0.86
2) Planning & Organizing	24.0	20.11	0.84
3) Problem Solving Prevention & Decision Making	23.6	16.68	0.71
4) Business Fundamentals	23.8	15.49	0.65
5) Checking, Examining & Recording	23.6	14.58	0.62
6) Computer Applications	24.0	14.82	0.61
7) Health & Safety	23.4	14.37	0.61
8) Creative Thinking	24.0	13.78	0.57

From Table 4.19, **Networking** has maximum Measurement of importance level = **0.86**, Sub-factor **Planning & Organizing** has the second value of Measurement of importance level **0.84**, Sub-factor **Problem Solving Prevention & Decision Making** has the third value of Measurement of importance level **0.71**, The other sub-factor **Business Fundamentals, Checking, Examining & Recording and Computer Applications** have the Measurement of importance level = **0.65, 0.62 and 0.61** respectively.

Table 4.20 Show the Entrepreneurship competencies tiers 4 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 4 – Industry – Wide Technical Competencies			
1) Principles of Entrepreneurship	23.8	21.08	0.89
2) Planning	23.4	18.83	0.80
3) Innovation & Invention	23.8	17.20	0.72
4) Business Operations	23.4	16.25	0.69
5) Risk Assessment & Management	23.2	15.97	0.68
6) Financial Management	23.6	12.49	0.52

From Table 4.20, **Principles of Entrepreneurship** has maximum Measurement of importance level = **0.89**, Sub-factor **Planning** has the second value of Measurement of importance level **0.80**, Sub-factor **Innovation & Invention** has the third value of Measurement of importance level **0.72**, The other sub-factor **Business Operations, Risk Assessment & Management and Financial Management** have the Measurement of importance level = **0.69, 0.68 and 0.52** respectively.

Table 4.21 Show the Entrepreneurship competencies tiers 3 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV x %)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 5 – Industry – Sector Functional Areas			
1) Social Entrepreneurship	20.0	18.71	0.93
2) Youth Entrepreneurship	24.0	20.11	0.84
3) Communication: Listening & Speaking	23.8	15.97	0.67
4) Science & Technology	23.8	15.29	0.64
5) Critical & Analytical Thinking	23.8	14.82	0.62
6) Reading	24.0	9.66	0.40

From Table 4.21, **Social Entrepreneurship** has maximum Measurement of importance level = **0.93**, Sub-factor **Youth Entrepreneurship** has the second value of Measurement of importance level **0.84**, Sub-factor **Communication: Listening & Speaking** has the third value of Measurement of importance level **0.67**, The other sub-factor **Science & Technology, Critical & Analytical Thinking and Reading** have the Measurement of importance level = **0.64, 0.62 and 0.40** respectively.

Table 4.22 Show the Entrepreneurship and Training competencies tiers 6 comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.) and Measurement of importance level (Coefficient of Variation: CV)

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
Tier 6 – Professional in Entrepreneurship and Training			
1) Global Awareness	23.8	26.83	1.12
2) Professional Training	24.0	18.50	0.77
3) Marketing Training	24.0	17.94	0.74
4) IT and Automation	23.8	17.20	0.72

From Table 4.22, **Global Awareness** has maximum Measurement of importance level = **1.12**, Sub-factor **Professional Training** has the second value of Measurement of importance level **0.77**, Sub-factor **Marketing Training** has the third value of Measurement of importance level **0.74**, The other sub-factor **IT and Automation** have the Measurement of importance level = **0.72** respectively.

From the analysis results in Table 4.17-4.22, it shows the Entrepreneurship competencies 6 Tiers comparison by Average importance level $(\bar{x})$, Standard deviation (S.D.), and Measurement of importance level (Coefficient of Variation: CV). This displays the analysis of the $(\bar{x})$, S.D., and CV values of subfactors under each main factor Tier 1-6. The analysis results have been utilized to arrange the subfactors' importance levels from highest to lowest according to the Measurement of importance level (Coefficient of Variation: CV). The results are as shown in the table above, and they will be further summarized and discussed in Chapter 5. In addition, the obtained $(\bar{x})$ values of the main factors in Engineering Management competencies can be used to conduct hypothesis testing to measure the differences among the main factors, all six of them. For example, a hypothesis test can be formulated as follows:

H_0 : The means of the main factors in Entrepreneurship skills are not significantly different.

H_a : The means of the main factors in Entrepreneurship skills are significantly different.

or

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$

H_a: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5 \neq \mu_6$

Based on the hypotheses stated above, to test the differences among the main factors, this research has preliminarily outlined a framework. This framework serves as a guideline for future research endeavors.

Table 4.23 Comparison between Tier 1-5 of Engineering Management's factors

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
1) Tier 2 – Academic Competencies	37.14	11.068	0.29
2) Tier 1 – Personal Effectiveness Competencies	27.57	6.848	0.24
3) Tier 5 – Industry – Sector Functional Areas	26.95	6.649	0.24
4) Tier 3 – Workplace Competencies	41.68	8.604	0.20
5) Tier 4 – Industry – Wide Technical Competencies	27.93	4.492	0.16
6) Tier 6 – Professional in Engineering Management and Training	23.56	3.738	0.15

Table 4.24 Comparison between tier 1-6 of Entrepreneurship's factors

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
1) Tier 1 – Personal Effectiveness Competencies	23.206	4.611	0.19
2) Tier 2 – Academic Competencies	23.933	4.712	0.19
3) Tier 3 – Workplace Competencies	23.725	3.921	0.16
4) Tier 5 – Industry – Sector Functional Areas	22.200	3.640	0.16
5) Tier 6 – Professional in Engineering Management and Entrepreneurship, and Training	23.561	3.738	0.15
6) Tier 4 – Industry – Wide Technical Competencies	23.567	3.430	0.14

Table 4.25 Comparison between tier 1-5 of Engineering Management and Entrepreneurship's factors

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	Average importance level	Standard deviation	Measurement of importance level
1) Entrepreneurship	32.446	8.333	0.21
2) Engineering Management	23.381	4.312	0.18

4.4 Summary of Results

From Chapter 3, the results of the questionnaire conducted with experts align with the main and subfactors related to the abilities required by students for careers in Engineering Management programs and entrepreneurial programs. This indicates that the structure of the main and subfactors related to the abilities required by students for careers in Engineering Management programs and entrepreneurial programs is accurate, comprehensive, and can be used for further investigation and consultation with relevant stakeholders. Following the data collection from the questionnaire, statistical analysis was conducted, which included:

(1) Analysis of questionnaire data Part 1: Personal information analysis by calculating frequency and percentage.

(2) Analysis of questionnaire data Part 2: Importance level analysis of each factor related to the abilities required by students for careers in Engineering Management programs and entrepreneurial programs, comparing the importance level of each factor. The analysis results are as follows:

4.5.1 Analysis of personal data by calculating frequency and percentage, divided into 2 questions as follows:

Question 1: Respondent personal characteristics, including gender, age, education level, current position, duration in current position, work experience in construction, and current responsibilities. The analysis revealed that respondents' current positions varied significantly and were diverse. Each level was predominantly associated with the civil engineering profession and encompassed individuals with varying levels of experience. The duration in the highest position ranged from 4 months to 37 years. The roles included 1 Production Planning Engineer (0.83%), 14 Project Engineer (11.67%), 3 Purchase Engineer (2.50%), 2 QA Engineer (1.67%), 1 R&D Engineer (0.83%), 12 Sales Engineer (10.00%), 13 Site Engineer (10.83%), 3 Supervisor (2.50%), 4 Supplier QA Engineer (3.33%), and 26 persons in other positions (21.67%).

Question 2: Characteristics of the organization, including the total duration since establishment, estimated average value of operations conducted by the organization, and nature of projects and activities undertaken by the organization. The analysis revealed that the total

duration since establishment of the organization ranged from a minimum of 8 years to a maximum of 106 years.

4.5.2 Main and sub-factors related to the abilities required by students for careers in Engineering Management programs and entrepreneurial programs, comparing the ranking of each factor. The analysis is divided into 2 parts: analysis of all sub-factors and analysis of main factors.

From the analysis of sub-factors using weighted importance, the top 5 factors related to the abilities required by students for careers in Engineering Management programs and entrepreneurial programs are as follows:

4.4.1 Summary of Results and Hypotheses

The analysis of survey data yielded valuable insights into the factors influencing the competencies required for careers in engineering management and entrepreneurship programs. The key findings from the study can be summarized as follows:

Analysis of Personal Data:

Respondents' current positions varied across multiple levels, with each level associated with different responsibilities related to civil engineering professions.

The average duration in the current position was approximately 3.96 years, with a range from 1 month to 32 years.

The majority of respondents had experience in civil engineering, with civil engineering being the predominant educational background.

Analysis of Organizational Characteristics:

Organizations had a wide range of establishment durations, with an average of 21.50 years. The estimated average value of organizations' operations varied significantly, with some exceeding 10 billion baht. Projects undertaken by organizations encompassed diverse sectors such as residential, bridges, commercial buildings, factories, public utilities, roads, and others.

Main and Sub-factor Analysis:

Sub-factor analysis revealed the top five factors influencing students' abilities for careers in engineering management and entrepreneurship. These factors included the use of quality materials in construction, safety planning, cost management, quality management, and maintaining good relationships with colleagues.

The main factor analysis highlighted the significance of ethics and morality, construction and environmental management, health and safety in construction, construction personnel, and community development as critical factors for evaluating the sustainability of construction projects undertaken by contractors.

Chapter 5

Conclusions and Recommendation

5.1 Summary of Research Findings

The research findings provide valuable insights into the importance levels of main and sub-factors related to competencies required for careers in engineering management and entrepreneurship. By comparing these importance levels, the study highlights key areas where graduates need to focus their skills and development efforts. Additionally, a summary of hypothesis results offers a clear understanding of how different factors contribute to the overall competency framework.

5.1.1 Comparing of the Importance Levels of Main and Sub-factors

Through an in-depth analysis, the study compares the importance levels of main factors such as personal effectiveness competencies, academic competencies, workplace competencies, industry-wide technical competencies, and sector functional areas. Sub-factors within each category are also assessed, providing a comprehensive view of the competency landscape.

5.2 Recommendations

Based on the research findings, the following recommendations are proposed:

5.2.1 Recommendations for the Profession

Foster collaboration between academic institutions and industry partners to ensure that curriculum content aligns with the evolving needs of the profession.

Encourage the integration of practical experience and real-world projects into educational programs to enhance students' readiness for the workforce.

5.2.2 Recommendations for Skills and Abilities

5.2.2. (1) Engineering Management

Emphasize the development of interpersonal skills, initiative, and adaptability to effectively navigate dynamic work environments.

Strengthen academic competencies in areas such as critical thinking, communication, and problem-solving to prepare graduates for leadership roles.

5.2.2 (2) Entrepreneurship

Cultivate an entrepreneurial mindset by promoting creativity, risk-taking, and opportunity-seeking behaviors.

Provide training and support in business fundamentals, marketing, and strategic management to equip graduates with the skills needed to launch and sustain successful ventures.

5.2.2. (3) Hypothesis Test

Based on the hypotheses stated above, to test the differences among the main factors, this research has preliminarily outlined a framework. This framework serves as a guideline for future research endeavors.

5.3 Critique of the Research

While the research offers valuable insights into competency requirements for engineering management and entrepreneurship careers, several limitations should be acknowledged. These include potential biases in survey responses, the reliance on self-reported data, and the generalizability of findings across different contexts. Future research endeavors should address these limitations through more diverse sampling methods, longitudinal studies, and qualitative analyses to provide a more comprehensive understanding of competency development in these fields.

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Appendix A

Operational Definitions

Operational Definitions

1. Leadership Skills: The ability to inspire, guide, and influence individuals or teams towards achieving organizational goals within the context of engineering management and entrepreneurship.

2. Problem-Solving Abilities: The capacity to identify, analyze, and resolve complex issues and challenges encountered in engineering management and entrepreneurship contexts.

3. Communication Proficiency: The skill to effectively convey ideas, information, and directives through verbal, written, and non-verbal means to various stakeholders within engineering management and entrepreneurship domains.

4. Strategic Thinking: The capability to envision long-term objectives, formulate plans, and make decisions aligned with organizational goals and market trends in engineering management and entrepreneurship.

5. Innovation and Creativity: The aptitude to generate novel ideas, solutions, and approaches to address business opportunities or technological advancements in engineering management and entrepreneurship fields.

6. Financial Acumen: The understanding and ability to manage financial resources, analyze financial data, and make informed decisions to ensure the financial viability and sustainability of engineering management and entrepreneurship initiatives.

Operational Definitions (continued)

7. Project Management Skills: The proficiency in planning, organizing, executing, and controlling projects efficiently and effectively to achieve desired outcomes within engineering management and entrepreneurship projects.

8. Networking and Relationship Building: The capability to cultivate and maintain professional relationships, networks, and partnerships to leverage resources, opportunities, and support for engineering management and entrepreneurship endeavors.

9. Adaptability and Resilience: The capacity to embrace change, overcome setbacks, and navigate uncertainties while remaining flexible and resilient in the dynamic environments of engineering management and entrepreneurship.

10. Ethical and Social Responsibility: The commitment to uphold ethical principles, integrity, and social accountability in decision-making and actions related to engineering management and entrepreneurship, considering the impact on stakeholders and society as a whole.

Appendix B

Questionnaire

Factors of Competencies of Desired Graduates for Careers in Engineering Management and Entrepreneurship Program

Bachelor of Engineering in Engineering Management and Entrepreneurship, Civil Engineering Department,

Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand.

This questionnaire is part of a study under the Bachelor of Engineering program in EME, School of Engineering, King Mongkut's Institute of Technology Ladkrabang. Its purpose is to gather information regarding Factors of Competencies of Desired Graduates for Careers in Engineering Management and Entrepreneurship Program.

*Information obtained from this questionnaire will be used for educational purposes only and will be kept confidential. There is no way to identify or refer to individual respondents. Once this study is concluded, the data collected from you will be immediately destroyed. To ensure the highest benefit from your responses, please answer truthfully. This questionnaire is divided into two parts and takes approximately 15-20 minutes to complete.

Thank you very much for participating and providing your responses to the questionnaire.

Section 1: Your Qualifications and Organization

Response Guidelines: Please fill in the blanks and write √ within the ❍ ,and be truthful (you may write √ more than one, if applicable).

1. May I know your qualifications as follows?

1.1 Gender

❍ Male

❍ Female

1.2 Age

❍ < 18

❍ 18 – 23

❍ 24 – 26

❍ 27 – 35

❍ 35 – 60

❍ > 60

1.3 Educational Qualifications (All):

❍ High School

❍ Bachelor's Degree

❍ Master's Degree

❍ Doctorate Degree

❍ Others.....

1.4 Current Position: ....

1.5 Duration in Current Positions: ..... years .....months

1.6 Your current responsibilities are related to.....

2. Inquire about your organization's qualifications as follows:

2.1 Total duration since the organization was established: ..... years

Section 2: Information about the main and sub-factors that are crucial for the sustainability of the village allocation project. This section separates questions based on the 7 main factors and further breaks them down into sub-factors. The importance of each sub-factor is assessed using a significance scale as follows:

1. Indicates **very low** or no significance for indicating the sustainability level of the village allocation project.
2. Indicates **low** significance for indicating the sustainability level of the project owner's organization.
3. Indicates **moderate** significance for indicating the sustainability level of the project owner's organization.
4. Indicates **high** significance for indicating the sustainability level of the project owner's organization.
5. Indicates **very high** significance for indicating the sustainability level of the project owner's organization.

* Please provide ○ numerical responses from 1-5 as specified can only be selected, with only one answer allowed per factor. **Factors that are crucial for indicating the importance of occupation and skills** are shown in the table below. Please provide the level of importance for each factor to analyze the obtained data in the next step.

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
List of job in Engineering Management and Entrepreneurship field					

1) Engineering Entrepreneur					
2) Business Development Engineer					
3) Engineering Management Analysts, Engineering Management Consultant					
4) Facilities Engineer / Operations Engineer / Research and Development Engineer					
5) General and Operations Engineer, Business Engineer, Store Engineer					
6) Human Factors Engineer, Ergonomists, Cognitive Engineer					
7) Manufacturing Engineers / Plant Engineer / Process Engineer					
8) Marketing Engineer					
9) Office Engineer, Administrative Services Engineer					
10) Product Sales Engineer, Sales Engineer, Technical Sales Engineer					
11) Purchasing Engineer					
12) System Engineer					
13) Validation Engineer / Reliability Engineer / Product Quality Engineer					
14) Construction Engineer					
15) Cost Engineer, Cost Estimator, Cost Consultant					

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
List of job in Engineering Management and Entrepreneurship field					

16) Logistics Engineer, Reliability Engineer, Supportability Engineer, System Engineer					
17) Supply Chain Engineer, Solution design and Analysis					
18) Smart City and Infrastructure Engineer					
Tier 1 – Personal Effectiveness Competencies					
1) Interpersonal Skills					
2) Initiative					
3) Integrity & Perseverance					
4) Professionalism					
5) Adaptability, Resilience, Flexibility, Stress Tolerance					
6) Dependability & Reliability					
7) Lifelong Learning					
Tier 2 – Academic Competencies					
1) Engineering Management					
2) Writing					
3) Mathematics					
4) Science & Technology					
5) Communication: Listening & Speaking					
6) Critical & Analytical Thinking					
7) Computer Skills					
Tier 3 – Workplace Competencies					
1) Teamwork					
2) Client/Stakeholder Focus					

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 3 – Workplace Competencies					
3) Planning & Organizing					
4) Creative Thinking					
5) Problem Solving Prevention & Decision Making					
6) Seeking & Developing Opportunities					
7) Working with Tools & Technology					
8) Scheduling & Coordinating					
9) Checking, Examining & Recording					
10) Business Fundamentals					
Tier 4 – Industry – Wide Technical Competencies					
1) Foundations of Engineering					
2) Design					
3) Manufacturing & Construction					
4) Operations & Maintenance					
5) Professional Ethics					
6) Business, Legal & Public Policy					
Tier 5 – Industry – Sector Functional Areas					
1) Smart City					
2) Construction Engineering Management					
3) Logistics and Supply Chain					
4) System Engineering					
Tier 6 – Professional in Engineering Management and Training					
1) Decision and Multi-Analysis					
2) Strategic Management					
3) Ergonomics & Human Factor					
4) Economics Engineering					

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 6 – Professional in Engineering Management and Training					
5) Engineering Management					
6) Business Capital Assistance					
7) Office Administration					
8) Risk Management					
9) Production and Operation Management					
10) Production Training					
11) Production Process and Design					
12) Quality Control					
13) Project Management					
14) External Collaboration					
Tier 1 – Personal Effectiveness Competencies					
1) Entrepreneurship & Startup					
2) Digital quotient literacy & Digital media Production					
3) Ambition					
4) Leadership & Social Influence					
5) Willingness to take Risks					
6) Willingness to Lean					
Tier 2 – Academic Competencies					
1) Reading					
2) Writing					
3) Mathematics					
4) Science & Technology					
5) Communication: Listening & Speaking					
6) Critical & Analytical Thinking					
7) Small Business Development					

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 2 – Academic Competencies					
8) Social Entrepreneurship					
9) High-Growth, High Value Entrepreneurship					
Tier 3 – Workplace Competencies					
1) Creative Thinking					
2) Networking					
3) Planning & Organizing					
4) Problem Solving Prevention & Decision Making					
5) Checking, Examining & Recording					
6) Business Fundamentals					
7) Computer Applications					
8) Health & Safety					
Tier 4 – Industry – Wide Technical Competencies					
1) Principles of Entrepreneurship					
2) Innovation & Invention					
3) Planning					
4) Marketing					
5) Financial Management					
6) Business Operations					
7) Risk Assessment & Management					
Tier 5 – Industry – Sector Functional Areas					
1) Youth Entrepreneurship					
2) Micro-Enterprise					
3) Small Business Development					
4) Social Entrepreneurship					

Factors of competencies of desired graduates for careers in engineering management and entrepreneurship programs	5	4	3	2	1
Tier 5 – Industry – Sector Functional Areas					
5) High-Growth, High Value Entrepreneurship					
Tier 6 – Professional in Entrepreneurship and Training					
1) Global Awareness					
2) Planning					
3) Marketing					
4) Financial Management					