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Project Engineers' Soft Skills on the Success of Construction Projects at Isabela Second District Engineering Office, Philippines

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ABSTRACT

This study examined the role of soft skills in the success of construction projects within the Philippine construction industry. The primary objective of this research was to contribute to the existing body of knowledge in project management by evaluating the soft skills of project engineers involved in flood control, school building, and road concreting projects at the Isabela Second District Engineering Office. A descriptive-correlational research design was employed, with data collected through a survey questionnaire. The respondents regarded analytical skills and leadership accountability skills as the most important factors to succeed in meeting the desired project quality, for all types of projects. The results revealed that there are no statistically significant differences in how respondents, when grouped by their profile, perceive the importance of these skills for all project outcomes, stressing that soft skills are equally important across all ages, gender, professions, positions, service years, and project types. Furthermore, the respondents pointed out that there is currently a dearth of soft skills in the construction industry, but all agreed on the significance of developing soft skills in the construction sector regardless of project type.

Keywords: *Construction; Project Engineer; Project Success; Soft Skills*

INTRODUCTION

The construction industry is regarded as the economic backbone of all countries (Zunjarrao, 2017). It is the sector of the economy that involves the planning, designing, building, and maintenance of structures such as buildings, roads, bridges, and other infrastructure. It significantly impacts the economic growth of many countries at 6% to 9% of their gross domestic product (GDP) typically. Thus, construction, as a key generator of jobs, contributes to overall employment rates (Bascon et al., 2023).

One of the most important, if not the most important, responsibilities of a project engineer therefore is to ensure the project's success. Since a project is aimed at producing something unique, project management technically involves utilizing knowledge, skills, tools, and techniques to meet the desired requirements and fulfill the expectations of project stakeholders (Demeke, 2018). Consequently, a successful project is conventionally marked by substantial investments, efficient project duration, and significant resource allocation, regardless of the project's nature (Pantalunan et al., 2021). Achieving successful projects is imperative (Williams, 2016), thereby presenting management as a formidable task, primarily attributed to the considerable effects of construction on the environment, economy, and the neighboring community (Hwang et al., 2015).

In general, project management skills include planning, appraisal, monitoring, scheduling, and risk management (Robles, 2012). While these factors are primary in the field of the construction industry, certain skills are innate to successful managers, termed soft skills. Soft skills encompass the personal characteristics, attributes, qualities, and behaviors of individuals (Demeke, 2018), which include but are not limited to communication, conflict resolution, negotiation, leadership, motivation, time management, presentation, problem-solving, analytical thinking, flexibility, assertiveness, mentoring and coaching, establishing business relationships, nonverbal communication, and body language, personal ability to function harmoniously with others, embrace new ideas, handle challenging situations and differing viewpoints with tolerance, stress management, customer service skills, and mediation skills (Matturro et al., 2019; Steyn et al., 2016; Love et al., 2002).

The implications of soft skills combined with hard skills are gaining prominence (Robles, 2012), as soft skills include the capacity to work with diverse types of people, personality attributes, stress management, leadership, dispute resolution, and communication. At present, several research studies have investigated factors influencing project success, with some emphasizing the role of insufficient soft skills in project management professionals as a significant cause of project failures (Heerden et al., 2023). Such a dilemma emphasizes the importance of soft skills in the field of project management, despite the recognition that both hard and soft skills should function in tandem to produce project success (Ahmed, 2022).

In 2021, the Philippine construction market had an estimated value of $54.5 billion. It is expected that factors such as the Build, Build, Build (BBB) program, global economic improvements, and increased construction demand will contribute to a projected annual average growth rate (AAGR) of over 7% between 2023 and 2026 (Bascon et al., 2023). Hence, it is anticipated that in the forthcoming years, there will be an increased demand for project management as a growing number of projects will need to be effectively supervised and coordinated. Additionally, the emergence of the "Build, Build, Build" program resulted in the identification of hard-to-fill skills, emerging skills, and soft skills required in the construction sector (Technical Education and Skills Development Authority, 2019).

The Department of Public Works and Highways (DPWH) is the primary government agency responsible for implementing infrastructure projects aligned with national development goals. DPWH is currently tasked with the planning, construction, and maintenance of different infrastructure projects, including national

highways, flood control systems, and other public works that are in line with national development goals. Within its structure, the Isabela Second District Engineering Office (ISDEO), one of eleven districts in the Cagayan Valley region.

In ISDEO, more than 100 projects are completed each year. Project engineers in ISDEO are tasked with critical responsibilities such as quality control, specification compliance, inspections, and monitoring to ensure project success. DPWH project engineers serve as the government-side personnel in charge of the entire construction process from start to finish, with the primary goal of attaining project success. While the DPWH project engineer is in charge of overall project execution, the private sector appoints engineers to handle labor and resource management, as well as to ease communication with the other engineers. While hard skills are conventionally applied to achieve this goal, it's critical to understand the attributes that influence project success, with an emphasis on soft skills.

The primary focus of this study will revolve around evaluating the influence of soft skills possessed by project engineers, both within the government and private sectors, on the success of construction projects conducted within ISDEO. The findings and insights that will be derived from this study are expected to provide a valuable perspective on the significance of soft skills in the realm of project management, contributing to a deeper understanding of their impact on project outcomes and overall success.

Objectives of the Study

The main objective of this study is to assess the soft skills of project engineers that influence the success of construction projects implemented by DPWH-ISDEO. Specifically, it aims to answer the following objectives: (1) To determine the profile of respondents in terms of age, sex, years in the service, and position. (2) To identify the soft skills that ensure construction project success. (3) To assess the perception of project engineers on the soft skills that contribute to project success. (4) To analyze if there is a significant difference in the soft skills of the project engineers when grouped according to their profile variables.

MATERIALS AND METHODS

Research Design

This study employed a descriptive-correlational research design. The descriptive part describes the soft skills present in the industry while the correlational part examines the relationship across variables. Particularly, the study employed a cross-sectional study design since it generally aims to evaluate the influence of project engineers' soft skills on the success of construction projects in Isabela Second District Engineering Office. Therefore, the data collected will predominantly pertain to the period when it is gathered.

Sampling Technique

The researcher employed a purposive sampling method, which falls under the non-probability sampling category. For this study, projects included a school building, flood control, and a road. From these projects, the respondents were those directly involved in the project: district engineer, assistant district engineer, chief of planning and design section, chief of construction section, chief of quality assurance section, chief of maintenance section, project engineers, and materials engineer from the DPWH; project manager, project engineer, and foreman from the contractor's side; while the principal and barangay captains were some of those representing community involvement to the project.

Locale of the study

The study area for this research is centered around DPWH-ISDEO, one of the four engineering offices within the province of Isabela. Situated in San Antonio Roxas, Isabela, this government agency is at coordinates 17°05'17.6"N 121°36'59.0"E.

Research Instruments

The study instrument was a questionnaire composed of questions derived from prior studies on soft skills. The first stage in developing the questionnaire was to review

existing published questionnaires, such as those in Farrugia (2015) and Heerden et al. (2023), both of which can be self-administered. The questionnaire was divided into four parts.

The first part gathered respondent information, including age, sex, years in the service, and position. The second part addressed the soft skills possessed by the respondents, consisting of seven general soft skills, each with at least two specific predictors and descriptions to assess the skills currently possessed by project engineers in the study area. The third part examined the soft skills required for project success as perceived by the respondents, consisting of the same seven general soft skills, each with at least two specific predictors and descriptions to determine the soft skills required for project success as perceived by the respondent. The final part assessed the likelihood of project success based on soft skills to investigate the respondent's perspective on how the identified soft skills influenced project success.

Data Gathering Procedure

To gather relevant information on the respondents' profiles and assess the soft skills of project engineers influencing the success of DPWH-ISDEO construction projects, the researcher developed a structured survey questionnaire based on the study's objectives and literature review. Following pilot testing for reliability and validity, the finalized instrument was used in the main survey. Purposive sampling targeted key personnel involved in three completed DPWH projects—one each for Flood Control, School Building, and Road—with no time extensions, variation orders, and formally accepted by the agency. Necessary permissions were secured through formal request letters. The researcher personally administered and retrieved the questionnaires to ensure a complete response rate. Collected data were then tallied, tabulated, computed, analyzed, and interpreted using proper statistical tools.

Analysis of the Data/ Statistical treatment

The research employed statistical analyses, including t-Test and ANOVA, to address the research problems and test the hypotheses, utilizing data gathered through a Likert-type scale survey. To achieve the first objective, respondents' profiles were collected via questionnaires and tabulated in Microsoft Excel for descriptive analysis. For the second objective, an extensive literature review was conducted to identify seven soft skills of project engineers, each with specific predictors and descriptions. These were validated locally through a pilot study using Cronbach's alpha to ensure reliability. Upon finalizing the localized soft skills, the main survey data were analyzed, and the Relative Importance Index (RII) method was used to rank the soft skills. Statistical tests were then applied to determine significant differences in soft skills across respondent profiles.

RESULTS AND DISCUSSION

Profile of the Respondents

Table 1. Frequency Distribution of Respondent's Gender

Gender	Frequency	Percentage
Male	35	97.22%
Female	1	2.78%
Total	36	100.00%

Table 1 shows the frequency distribution of the respondents' gender based on a sample size of 36 individuals. 97.22% of the respondents are male, while there was only one female respondent. This indicates that males are generally involved in construction projects: flood control, school building, and road concreting, or men have historically led the field of civil engineering.

Table 2. Frequency distribution of respondent's age

Age Group	Frequency	Percentage
20 years old and below	0	0.00%
21-30 years old	1	2.78%
31-40 years old	8	22.22%
41-50 years old	9	25.00%
51-60 years old	2	5.56%
above 60 years old	16	44.44%
Total	36	100.00%

Table 2 shows that most respondents are seniors over 60 years old, followed by those aged 41-50 and 31-40. The

smallest group is individuals aged 21-30, with only one respondent. This suggests that the respondents likely have substantial field experience, with older age brackets indicating more years of involvement in the industry.

Table 3. Frequency distribution of respondents' profession

Profession	Frequency	Percentage
Civil Engineer	29	80.56%
Barangay Official	2	5.56%
Teacher	1	2.78%
Lawyer	1	2.78%
Construction Worker	3	8.33%
Total	36	100.00%

Table 3 presents the frequency distribution of the respondents' profession. Since construction projects are involved in this research, most respondents are civil engineers. Other respondents include barangay officials, a teacher, a lawyer, and construction workers.

Table 4. Frequency distribution of respondents' position

Profession	Frequency	Percentage
District Engineer	3	8.33%
Assistant District Engineer	3	8.33%
Engineer II	6	16.67%
Engineer III	12	33.33%
Project Engineer	3	8.33%
Project Manager	3	8.33%
Principal	1	2.78%
Barangay Captain	2	5.56%
Foreman	3	8.33%
Total	36	100.00%

Regarding their positions in Table 4, three respondents are District Engineers. There were also three Assistant District Engineers. Most of the respondents at 33.33%, are in Engineer III positions, followed by Engineer II positions (16.67%). Other respondents are positioned as Project Engineers, Project Managers, Barangay Captains, and Foremen. There is only one respondent in the academe (i.e., for the school building project), under the Principal position. Specifically, three under the Engineer II position are also project engineers, hence a total of 6 project engineers.

Table 5. Frequency distribution of respondents' number of service years

Number of Service Years	Frequency	Percentage
1-5 years	1	2.78
6-10 years	9	25.00
11-15 years	9	25.00
16-20 years	1	2.78
21-25 years	0	0.00
26-30 years	1	2.78
31-35 years	0	0.00
36-40 years	12	33.33
> 40 years	3	8.33

Table 5 shows that most of the respondents have been in the service for 36-40 years. Nine respondents have been serving for 11-15 years and 6-10 years. Thus, it can be inferred that the study's respondents have an extensive range of experiences in service.

Additionally, 34 out of 36 respondents agreed (i.e., two foremen disagreed) that there is currently a lack of soft skills in the construction industry, while all of them believed in the importance of cultivating soft skills within the construction industry regardless of the project type.

RII Ranking of Soft Skills

Soft Skills of the Project Engineer during Construction

The ranking of soft skills is based on their importance to project success, focusing on the soft skills of project engineers during construction. Respondents rated the soft skills they believed project engineers effectively applied, contributing to the overall success of the project.

Table 6. Ranking of soft skills for project engineers during construction using Relative Important Index (RII)

Soft Skills	Predictors	Flood Control		School Building		Road Concreting	
		RII	Rank	RII	Rank	RII	Rank
Communication	Verbal Communication	0.9167	5	0.8500	5	0.8833	2
	Written Communication	0.8500	8	0.8167	7	0.8000	7
	Listening	0.9333	4	0.8833	2	0.8667	3
Problem-Solving	Analytical Skills	0.9333	4	0.9000	1	0.8833	2
	Critical Thinking	0.9167	5	0.8333	6	0.8667	3
Leadership	Mentorship	0.9000	6	0.8333	6	0.8500	4
	Ethical Leadership	0.9000	6	0.8167	7	0.8667	3
	Accountability	0.9500	3	0.8833	2	0.9333	1
Management	Risk Management	0.9167	5	0.9000	1	0.8500	4
	Time Management	0.9833	1	0.8500	5	0.8500	4
	Cost Awareness	0.9333	4	0.8500	5	0.8167	6
Teamwork	Collaboration	0.9333	4	0.8667	4	0.8833	2
	Adaptability	0.9667	2	0.8667	4	0.8333	5
	Efficiency	0.8833	7	0.8333	6	0.8833	2
Creativity	Innovative Solutions	0.9333	4	0.8000	8	0.8167	6
	Optimized Design	0.9333	4	0.8727	3	0.8500	4
Interpersonal Skills	Empathy	0.9167	5	0.8167	7	0.8333	5
	Conflict Resolution	0.9000	6	0.8333	6	0.8333	5
	Negotiation	0.9333	4	0.8833	2	0.8667	3
	Feedback	0.9167	5	0.8500	5	0.8500	4

Table 6 shows the ranking of soft skills based on their relative importance index (RII) for project engineers in different construction projects. For flood control projects, time management (RII = 0.9833) was the most crucial skill, followed by adaptability (RII = 0.9667) and accountability in leadership (RII = 0.9500), while written communication (RII = 0.8500) was considered the least important. In school building projects, risk management and analytical skills (RII = 0.9000) were ranked highest, followed by leadership accountability, listening skills, and negotiation skills (RII = 0.8833), with innovative solutions (RII = 0.8000) being the least important. For road concreting projects, leadership accountability (RII = 0.9333) ranked as the most vital skill, followed by efficiency, verbal communication, analytical skills, and collaboration (RII = 0.8833), while written communication (RII = 0.8000) was again deemed the least important. Overall, all soft skills were recognized as essential for success across the different projects.

Table 7. Overall ranking of soft skills for project engineers during actual construction

Soft Skills	Predictors	Project Type	
		RII	Rank
Communication	Verbal Communication	0.8833	6
	Written Communication	0.8222	12
	Listening	0.8944	3
Problem-Solving	Analytical Skills	0.9056	2
	Critical Thinking	0.8722	7
Leadership	Mentorship	0.8611	9
	Ethical Leadership	0.8611	9
	Accountability	0.9222	1
Management	Risk Management	0.8889	4
	Time Management	0.8944	3
	Cost Awareness	0.8667	8
Teamwork	Collaboration	0.8944	3
	Adaptability	0.8889	4
	Efficiency	0.8667	8
Creativity	Innovative Solutions	0.8500	11
	Optimized Design	0.8857	5
Interpersonal Skills	Empathy	0.8556	10
	Conflict Resolution	0.8556	10
	Negotiation	0.8944	3
	Feedback	0.8722	7

Leadership accountability (RII = 0.9222) was identified as the most crucial factor contributing to project success, followed by analytical skills. This underscores the importance for project engineers to focus on enhancing their leadership and problem-solving abilities throughout the construction process. Written

communication remained the least important variable (RII = 0.8222), yet recognizing the importance of writing documents and letters in processing construction papers should not be undermined.

Required Soft Skills toward Project Success in terms of Time

Table 8. Ranking of soft skills to achieve project success in terms of time

Soft Skills	Predictors	Flood Control		School Building		Road Concreting	
		RII	Rank	RII	Rank	RII	Rank
Communication	Verbal Communication	0.9833	2	0.9667	2	0.9667	1
	Written Communication	0.9833	2	0.9333	4	0.9333	3
	Listening	0.9833	2	0.9667	2	0.9667	1
Problem-Solving	Analytical Skills	1.0000	1	0.9833	1	0.9667	1
	Critical Thinking	0.9667	3	0.9667	2	0.9500	2
Leadership	Mentorship	0.9667	3	0.9667	2	0.9167	4
	Ethical Leadership	0.9833	2	0.9167	5	0.9333	3
	Accountability	1.0000	1	0.9833	1	0.9667	1
Management	Risk Management	0.9833	2	0.9667	2	0.9000	5
	Time Management	0.9667	3	0.9667	2	0.9667	1
	Cost Awareness	0.9667	3	0.9333	4	0.9333	3
Teamwork	Collaboration	0.9667	3	0.9500	3	0.9167	4
	Adaptability	0.9667	3	0.9500	3	0.9167	4
	Efficiency	0.9833	2	0.9667	2	0.9333	3
Creativity	Innovative Solutions	0.9667	3	0.9500	3	0.9333	3
	Optimized Design	0.9833	2	0.9667	2	0.9333	3
Interpersonal Skills	Empathy	0.9667	3	0.8833	6	0.9167	4
	Conflict Resolution	0.9667	3	0.9333	4	0.9167	4
	Negotiation	1.0000	1	0.9667	2	0.9667	1
	Feedback	0.9833	2	0.9500	3	0.9167	4

Table 8 reveals that respondents identified analytical skills and leadership accountability as the most crucial soft skills for ensuring project success in terms of time, cost, and quality, with an RII of 1.0000 across all project types. In addition, negotiation skills are important for both flood control and road concreting projects, while verbal skills, listening skills, and time management skills are deemed effective soft skills for road concreting projects as well.

Table 9. Overall ranking of soft skills to achieve project success in terms of time

Soft Skills	Predictors	Flood Control	
		RII	Rank
Communication	Verbal Communication	0.9722	3
	Written Communication	0.9500	6
	Listening	0.9722	3
Problem-Solving	Analytical Skills	0.9833	1
	Critical Thinking	0.9611	5
Leadership	Mentorship	0.9500	6
	Ethical Leadership	0.9444	7
	Accountability	0.9833	1
Management	Risk Management	0.9500	6
	Time Management	0.9667	4
	Cost Awareness	0.9444	7
Teamwork	Collaboration	0.9444	7
	Adaptability	0.9444	7
	Efficiency	0.9611	5
Creativity	Innovative Solutions	0.9500	6
	Optimized Design	0.9611	5
Interpersonal Skills	Empathy	0.9222	9
	Conflict Resolution	0.9389	8
	Negotiation	0.9778	2
	Feedback	0.9500	6

Overall, analytical skills and leadership accountability (RII = 0.9833) are crucial for project success in terms of time, as presented in Table 9. Thus, project engineers may hone such skills. Interpersonal skills like empathy and conflict resolution are the least important skills for project engineers to meet deadlines or project schedules.

Required Soft Skills toward Project Success in terms of Cost

Table 10. Ranking of soft skills to achieve project success in terms of cost

Soft Skills	Predictors	Flood Control		School Building		Road Concreting	
		RII	Rank	RII	Rank	RII	Rank
Communication	Verbal Communication	0.9500	5	0.9500	3	0.8833	6
	Written Communication	0.9667	3	0.9333	4	0.9000	5
	Listening	0.9667	3	0.9667	2	0.9333	3
Problem-Solving	Analytical Skills	1.0000	1	0.9667	2	0.9333	3
	Critical Thinking	0.9833	2	0.9500	3	0.9167	4
Leadership	Mentorship	0.9833	2	0.9500	3	0.9333	3
	Ethical Leadership	0.9667	3	0.9167	5	0.9167	4
	Accountability	1.0000	1	0.9667	2	0.9667	1
Management	Risk Management	0.9667	3	0.9667	2	0.9167	4
	Time Management	0.9500	5	0.9333	4	0.9167	4
	Cost Awareness	0.9636	4	0.9667	2	0.9500	2
Teamwork	Collaboration	0.9500	5	0.9500	3	0.9167	4
	Adaptability	0.9500	5	0.9500	3	0.8833	6
	Efficiency	0.9500	5	0.9667	2	0.9000	5
Creativity	Innovative Solutions	0.9500	5	0.9500	3	0.9000	5
	Optimized Design	0.9667	3	0.9667	2	0.9333	3
Interpersonal Skills	Empathy	0.9500	5	0.8833	6	0.9000	5
	Conflict Resolution	0.9833	2	0.9500	3	0.9167	4
	Negotiation	0.9833	2	0.9833	1	0.9333	3
	Feedback	0.9667	3	0.9500	3	0.9167	4

In Table 10, the respondents thought of analytical skills and leadership accountability skills as the most important factors to succeed in meeting the project cost or budget, for flood control projects, with RII at 1.0000; negotiation skills (RII = 0.9833) for school building projects; and, only accountability in leadership (RI = 0.9667) for road concreting projects.

Table 11. Overall ranking of soft skills to achieve project success in terms of cost

Soft Skills	Predictors	Flood Control	
		RII	Rank
Communication	Verbal Communication	0.9278	9
	Written Communication	0.9333	8
	Listening	0.9556	4
Problem-Solving	Analytical Skills	0.9667	2
	Critical Thinking	0.9500	5
Leadership	Mentorship	0.9556	4
	Ethical Leadership	0.9333	8
	Accountability	0.9778	1
Management	Risk Management	0.9500	5
	Time Management	0.9333	8
	Cost Awareness	0.9600	3
Teamwork	Collaboration	0.9389	7
	Adaptability	0.9278	9
	Efficiency	0.9389	7
Creativity	Innovative Solutions	0.9333	8
	Optimized Design	0.9556	4
Interpersonal Skills	Empathy	0.9111	10
	Conflict Resolution	0.9500	5
	Negotiation	0.9667	2
	Feedback	0.9444	6

Overall, the project engineer's leadership accountability (RII = 0.9778) proved to be the most critical factor for project success in terms of cost, as presented in Table 11, followed by negotiation and analytical skills (RII = 0.9667). The least crucial skill in meeting project cost or budget, as perceived by the respondents, is empathy (RII = 0.9111).

Required Soft Skills toward Project Success in terms of Quality

Table 12. Ranking of soft skills to achieve project success in terms of quality

Soft Skills	Predictors	Flood Control		School Building		Road Concreting	
		RII	Rank	RII	Rank	RII	Rank
Communication	Verbal Communication	0.9833	2	0.9667	2	0.9000	4
	Written Communication	1.0000	1	0.9333	4	0.9167	3
	Listening	0.9833	2	0.9667	2	0.9333	2
Problem-Solving	Analytical Skills	1.0000	1	0.9833	1	0.9500	1
	Critical Thinking	0.9833	2	0.9667	2	0.9333	2
Leadership	Mentorship	0.9833	2	0.9667	2	0.9167	3
	Ethical Leadership	0.9833	2	0.9333	4	0.9000	4
	Accountability	1.0000	1	0.9833	1	0.9500	1
Management	Risk Management	0.9833	2	0.9667	2	0.9333	2
	Time Management	0.9833	2	0.9667	2	0.9167	3
	Cost Awareness	0.9818	3	0.9500	3	0.9333	2
Teamwork	Collaboration	0.9833	2	0.9667	2	0.9000	4
	Adaptability	0.9500	4	0.9500	3	0.8833	5
	Efficiency	0.9833	2	0.9667	2	0.9333	2
Creativity	Innovative Solutions	0.9833	2	0.9667	2	0.9000	4
	Optimized Design	0.9833	2	0.9667	2	0.9167	3
Interpersonal Skills	Empathy	0.9500	4	0.9000	5	0.9167	3
	Conflict Resolution	1.0000	1	0.9500	3	0.9000	4
	Negotiation	1.0000	1	0.9500	3	0.9167	3
	Feedback	0.9833	2	0.9500	3	0.8667	6

In Table 12, the respondents thought analytical skills and leadership accountability skills were the most important factors for meeting the desired project quality for all types of projects, with RII at 1.0000. In addition, negotiation skills, written communication skills, and conflict resolution skills are likewise important for flood control projects.

Table 13. Overall ranking of soft skills to achieve project success in terms of quality

Soft Skills	Predictors	Flood Control	
		RII	Rank
Communication	Verbal Communication	0.9500	5
	Written Communication	0.9500	5
	Listening	0.9611	2
Problem-Solving	Analytical Skills	0.9778	1
	Critical Thinking	0.9611	2
Leadership	Mentorship	0.9556	3
	Ethical Leadership	0.9389	6
	Accountability	0.9778	1
Management	Risk Management	0.9611	2
	Time Management	0.9556	3
	Cost Awareness	0.9543	4
Teamwork	Collaboration	0.9500	5
	Adaptability	0.9278	8
	Efficiency	0.9611	2
Creativity	Innovative Solutions	0.9500	5
	Optimized Design	0.9556	3
Interpersonal Skills	Empathy	0.9222	9
	Conflict Resolution	0.9500	5
	Negotiation	0.9556	3
	Feedback	0.9333	7

Overall, analytical skills and leadership accountability (RII = 0.9778) are crucial for project success in terms of quality, as presented in Table 13, similar to the most important skills to meet project schedule and cost.

By ranking, the top three soft skills include problem-solving, leadership, and management skills. Problem-solving skills are important for project engineers in construction projects because they enable them to manage complexities, mitigate risks, improve efficiency, and ultimately deliver successful outcomes that satisfy both stakeholders and clients (Musonda & Okoro, 2021; Ahn et al., 2012). On the other hand, leadership skills empower project engineers to navigate the challenges of construction projects effectively, manage teams and stakeholders, make informed decisions, and ultimately achieve project success by delivering quality results on time and within budget (Musonda & Okoro, 2021; Muda et al., 2016). Finally, management skills empower project engineers to plan, organize, coordinate, and control all aspects of construction projects effectively. By leveraging these skills, project engineers can mitigate risks, optimize resources, ensure quality, meet deadlines, and deliver successful outcomes that meet or exceed stakeholder expectations (Khamaksorn, 2016).

Testing for Differences in Soft Skills According to Profile Groups

Statistical tests were conducted to assess significant differences in soft skills across independent groups. T-test was used to test the difference in soft skills when grouped according to age bracket, profession, and years in service, while ANOVA was used to test the difference in soft skills when grouped according to position and project type.

Test of Difference Between Age and Soft Skills

Table 14. Differences in Project Engineer soft skills when grouped according to age bracket

Success Indicator	Mean		t	Sig. (2-tailed)
	45 and below	Above 45		
Communication	4.083	4.533	-2.850	.007
Problem-solving	4.344	4.525	-1.017	.316
Leadership	4.313	4.483	-.940	.354
Management	4.396	4.433	-.205	.838
Teamwork	4.313	4.500	-1.108	.276
Creativity	4.188	4.450	-1.531	.135
Interpersonal Skills	4.094	4.550	-2.731	.010

Table 14 shows the analysis of the difference in soft skills of the project engineers when grouped according to age bracket. Out of the seven soft skills, only communication and interpersonal skills show significant differences ($p < 0.05$) among project engineers, while the other soft skills do not vary significantly ($p > 0.05$). When grouped by age, the significant difference in communication and interpersonal skills among project engineers can be attributed to several factors such as experience, adaptability to technology, generational differences, professional development, and other cultural or social factors. Older project engineers, with more years of experience, have refined their communication skills through various projects and interactions, while generational differences in communication preferences also influence how engineers interact with stakeholders.

Table 15. Differences in soft skills that PE should have to deliver project success in terms of time when grouped according to age bracket

Success Indicator	Mean		t	Sig. (2-tailed)
	45 and below	Above 45		
Communication	4.792	4.850	-.568	.574
Problem-solving	4.781	4.900	-1.061	.296
Leadership	4.667	4.900	-2.292	.028
Management	4.750	4.800	-.495	.624
Teamwork	4.750	4.750	0.000	1.000
Creativity	4.781	4.775	.048	.962
Interpersonal Skills	4.594	4.850	-2.290	.028

Table 15 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of time when grouped according to age bracket. Among the seven soft skills, only leadership and interpersonal skills have significant differences ($p < 0.05$). Ages above 45 strongly agree, while ages 45 and below only agree. This difference can be linked to the greater experience older engineers have in leadership roles, which enhances their leadership capabilities. However, younger project engineers, while possibly lacking extensive experience, may bring fresh perspectives and innovative ideas to leadership roles. Recognizing these differences can help organizations create inclusive leadership development programs that cater to the strengths and developmental needs of engineers across different age groups.

Table 16. Differences in soft skills that PE should have to deliver project success in terms of cost when grouped according to age bracket

Success Indicator	Mean		t	Sig. (2-tailed)
	45 and below	Above 45		
Communication	4.563	4.800	-1.522	.137
Problem-solving	4.625	4.925	-2.064	.047
Leadership	4.625	4.900	-2.392	.022
Management	4.667	4.800	-1.146	.260
Teamwork	4.583	4.750	-1.019	.315
Creativity	4.656	4.775	-.775	.444
Interpersonal Skills	4.547	4.850	-2.463	.019

Table 16 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of cost when grouped according to age bracket. Among the seven soft skills, problem-solving, leadership, and interpersonal skills have significant differences ($p < 0.05$). Ages above 45 strongly agree, while ages 45 and below only agree. Older project engineers, with more experience, excel in problem-solving, leadership, and cost management due to their refined technical skills and project management expertise, allowing them to anticipate challenges, make informed decisions, and manage budgets effectively. While older project engineers offer stability and experience, younger project engineers bring fresh perspectives and innovation, often leveraging new technologies to optimize efficiency and reduce costs.

Table 17. Differences in soft skills that PE should have to deliver project success in terms of quality when grouped according to age bracket

Success Indicator	Mean		t	Sig. (2-tailed)
	45 and below	Above 45		
Communication	4.604	4.900	-2.168	.037
Problem-solving	4.750	4.900	-1.039	.306
Leadership	4.646	4.900	-1.931	.062
Management	4.708	4.850	-1.188	.243
Teamwork	4.646	4.800	-.949	.349
Creativity	4.656	4.850	-1.281	.209
Interpersonal Skills	4.469	4.888	-2.846	.007

Table 17 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of quality when grouped according to age bracket. Among the seven soft skills, only leadership has a significant difference between age groups ($p < 0.05$). Ages above 45 strongly agree, while ages 45 and below only agree. This difference in leadership skills primarily stems from varying levels of experience, decision-making abilities, risk management expertise, communication skills, and a focus on continuous improvement in quality management. Successful project outcomes in terms of quality often require a balance of seasoned leadership with innovative thinking and collaboration among team members of different experience levels.

Table 18. Test of differences in the outcome variable when grouped according to age bracket

Outcome Variable	Mean		t	Sig. (2-tailed)
	45 and below	Above 45		
Time	4.813	4.800	.092	.928
Cost	4.750	4.800	-.349	.729
Quality	4.875	4.800	.586	.562

Overall, Table 18 shows the results of testing the difference in the outcome variable when grouped according to age bracket. It can be inferred that there is no significant difference in the outcome variable when grouped according to age bracket ($p > 0.05$).

Test of the Difference Between Profession and Soft Skills

Table 19. Differences in PE soft skills when grouped according to profession

Success Indicator	Mean		t	Sig. (2-tailed)
	CE	Non-CE		
Communication	4.402	4.048	1.672	0.104
Problem-solving	4.517	4.143	1.719	0.095
Leadership	4.506	4.000	2.360	0.024
Management	4.402	4.476	-0.323	0.749
Teamwork	4.425	4.381	0.205	0.839
Creativity	4.362	4.214	0.668	0.508
Interpersonal Skills	4.379	4.214	0.718	0.478

Table 19 shows the analysis of the difference in soft skills of the project engineers when grouped according to profession. Out of the seven soft skills, only leadership has a significant difference between groups ($p < 0.05$), while the other soft skills do not vary significantly between various professions ($p > 0.05$). The civil engineers strongly agree, while those who are not civil engineers only agree. This difference in leadership skills

can be linked to variations in technical expertise, industry knowledge, project complexity, communication, risk management practices, and adaptability to innovation, all of which are specific to each engineering discipline. Effective leadership in engineering projects requires understanding these profession-specific factors and tailoring leadership approaches to meet the unique challenges and requirements of each profession. Thus, giving more inclination to civil engineering-related fields.

Table 20. Differences in soft skills that PE should have to deliver project success in terms of time when grouped according to profession

Success Indicator	Mean		t	Sig. (2-tailed)
	CE	Non-CE		
Communication	4.793	4.952	-1.257	0.217
Problem-solving	4.810	5.000	-1.364	0.182
Leadership	4.782	4.857	-0.552	0.584
Management	4.736	4.952	-1.779	0.084
Teamwork	4.690	5.000	-1.904	0.065
Creativity	4.724	5.000	-1.745	0.090
Interpersonal Skills	4.724	4.786	-0.409	0.685

Table 20 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of time when grouped according to profession. It can be inferred that there is no significant difference in the soft skills that project engineers should have to deliver project success in terms of time when grouped according to profession ($p > 0.05$).

Table 21. Differences in soft skills that PE should have to deliver project success in terms of cost when grouped according to profession

Success Indicator	Mean		t	Sig. (2-tailed)
	CE	Non-CE		
Communication	4.632	4.952	-1.643	0.110
Problem-solving	4.741	5.000	-1.372	0.179
Leadership	4.770	4.810	-0.253	0.802
Management	4.690	4.952	-1.852	0.073
Teamwork	4.609	4.952	-1.716	0.095
Creativity	4.655	5.000	-1.865	0.071
Interpersonal Skills	4.707	4.750	-0.257	0.799

Table 21 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of cost when grouped according to the profession. It can be inferred that there is no significant difference in the soft skills that project engineers should have to deliver project success in terms of cost when grouped according to profession ($p > 0.05$).

Table 22. Differences in soft skills that PE should have to deliver project success in terms of quality when grouped according to profession

Success Indicator	Mean		T	Sig. (2-tailed)
	CE	Non-CE		
Communication	4.747	4.857	-0.605	0.549
Problem-solving	4.793	5.000	-1.145	0.260
Leadership	4.782	4.810	-0.160	0.874
Management	4.759	4.905	-0.969	0.339
Teamwork	4.667	5.000	-1.679	0.102
Creativity	4.741	4.857	-0.599	0.553
Interpersonal Skills	4.716	4.643	0.354	0.725

Table 22 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of quality when grouped according to the profession. It can be inferred that there is no significant difference in the soft skills that project engineers should have to deliver project success in terms of quality when grouped according to profession ($p > 0.05$).

Table 23. Test of differences in the outcome variable when grouped according to profession

Outcome Variable	Mean		t	Sig. (2-tailed)
	CE	Non-CE		
Time	4.793	4.857	-0.374	0.711
Cost	4.759	4.857	-0.549	0.586
Quality	4.828	4.857	-0.183	0.856

Overall, Table 23 shows the results of testing the difference in the outcome variable when grouped according to profession. It can be inferred that there is no significant difference in the outcome variable when grouped according to profession ($p > 0.05$).

Test of Difference Between Years in Service and Soft Skills

Table 24. Differences in PE soft skills when grouped according to service years

Success Indicator	Mean		t	Sig. (2-tailed)
	20 and below	Above 20		
Communication	4.133	4.583	-2.850	.007
Problem-solving	4.325	4.594	-1.536	.134
Leadership	4.283	4.563	-1.570	.126
Management	4.400	4.438	-.205	.838
Teamwork	4.333	4.521	-1.108	.276
Creativity	4.225	4.469	-1.415	.166
Interpersonal Skills	4.163	4.578	-2.443	.020

Table 24 shows the analysis of the difference in soft skills of the project engineers when grouped according to service years. Among the seven soft skills, only communication and interpersonal skills significantly differ among groups ($p < 0.05$). Those who are 20 years and above in service strongly agree, while those who rendered below 20 years in service only agree. This difference is rooted in the accumulation of experience, exposure to diverse projects and stakeholders, development of conflict resolution abilities, leadership roles, mentoring activities, adaptability to industry changes, and cultural sensitivity, all of which enhance the senior engineers' ability to communicate effectively and manage professional relationships in complex project settings.

Table 25. Differences in soft skills that PE should have to deliver project success in terms of time when grouped according to years in service

Success Indicator	Mean		t	Sig. (2-tailed)
	20 and below	Above 20		
Communication	4.833	4.813	.202	.841
Problem-solving	4.825	4.875	-.441	.662
Leadership	4.733	4.875	-1.328	.193
Management	4.800	4.750	.495	.624
Teamwork	4.800	4.688	.832	.411
Creativity	4.825	4.719	.816	.420
Interpersonal Skills	4.675	4.813	-1.166	.252

Table 25 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of time when grouped according to years in service. It can be inferred that there is no significant difference in soft skills that project engineers should have to deliver project success in terms of time when grouped according to their years of service ($p > 0.05$).

Table 26. Differences in soft skills that PE should have to deliver project success in terms of cost when grouped according to years in service

Success Indicator	Mean		t	Sig. (2-tailed)
	20 and below	Above 20		
Communication	4.650	4.750	-.624	.537
Problem-solving	4.700	4.906	-1.374	.178
Leadership	4.700	4.875	-1.451	.156
Management	4.733	4.750	-.141	.889
Teamwork	4.667	4.688	-.126	.901
Creativity	4.725	4.719	.040	.968
Interpersonal Skills	4.638	4.813	-1.344	.188

Table 26 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of cost when grouped according to years in service. It can be inferred that there is no significant difference in soft skills that project engineers should have to deliver project success in terms of cost when grouped according to their years of service ($p > 0.05$

Table 27. Differences in soft skills that PE should have to deliver project success in terms of quality when grouped according to years in service

Success Indicator	Mean		t	Sig. (2-tailed)
	20 and below	Above 20		
Communication	4.683	4.875	-1.352	.185
Problem-solving	4.800	4.875	-.513	.611
Leadership	4.717	4.875	-1.164	.252
Management	4.767	4.813	-.377	.708
Teamwork	4.717	4.750	-.203	.841
Creativity	4.725	4.813	-.568	.574
Interpersonal Skills	4.575	4.859	-1.819	.078

Table 27 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of quality when grouped according to service years. It can be inferred that there is no significant difference in soft skills that project engineers should have to deliver project success in terms of quality when grouped according to their years of service ($p > 0.05$).

Overall, Table 28 shows the results of testing the difference in the outcome variable when grouped according to service years. It can be inferred that there is no significant difference in the outcome variable when grouped according to their years in service ($p > 0.05$).

Table 28. Test of differences in the outcome variable when grouped according to service years

Outcome Variable	Mean		t	Sig. (2-tailed)
	20 and below	Above 20		
Time	4.800	4.813	-.092	.928
Cost	4.750	4.813	-.437	.665
Quality	4.850	4.813	.292	.772

Test of the Difference Between Position and Soft Skills

Table 29. Differences in PE soft skills when grouped according to position

Success Indicator	F	Sig. (2-tailed)
Communication	2.019	.095
Problem-solving	1.110	.381
Leadership	1.746	.146
Management	.707	.646
Teamwork	1.791	.136
Creativity	1.340	.272
Interpersonal Skills	2.463	.048

Table 29 shows the analysis in testing the difference in soft skills of the project engineers when grouped according to position. It shows that there is a significant difference in interpersonal skills ($p < 0.05$), but there are no significant differences in other soft skills. The significant difference in interpersonal skills among project engineers based on their organizational position highlights the varying role-specific demands, such as leadership, client interactions, technical responsibilities, team collaboration, cross-functional engagement, conflict resolution, and mentoring. These factors shape the development and use of interpersonal skills to meet the distinct challenges and expectations of each position within the engineering field.

Table 30. Differences in soft skills that PE should have to deliver project success in terms of time when grouped according to position

Success Indicator	F	Sig. (2-tailed)
Communication	1.277	.298
Problem-solving	1.466	.225
Leadership	2.212	.070
Management	2.616	.038
Teamwork	2.028	.094
Creativity	1.577	.189
Interpersonal Skills	2.405	.052

Table 30 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of time when grouped according to position. It can be inferred that there is a significant difference in management skills ($p < 0.05$), but there are no significant differences in other soft skills to deliver project success in terms of time. The significant difference in the management skills of project engineers, which are used to deliver project success in terms of time, based on their position, highlights the impact of experience, leadership, decision-making agility, effective communication, and strategic oversight. These factors, often associated with senior roles, enhance the ability to manage project complexities, allocate resources efficiently, mitigate risks, and maintain timelines for successful project completion.

Table 31. Differences in soft skills that PE should have to deliver project success in terms of cost when grouped according to position

Success Indicator	F	Sig. (2-tailed)
Communication	2.909	.024
Problem-solving	3.718	.007
Leadership	1.859	.122
Management	3.501	.010
Teamwork	2.475	.047
Creativity	2.237	.068
Interpersonal Skills	2.774	.030

Table 31 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of cost when grouped according to position. It can be inferred that there is a significant difference in communication, problem-solving, management, teamwork, and interpersonal skills ($p < 0.05$) in delivering project success in terms of cost. These differences reflect each role's varying responsibilities, decision-making authority, and leadership demands, with senior positions bearing greater accountability for strategic decision-making, resource management, risk mitigation, and stakeholder engagement—factors that collectively contribute to cost-efficient and sustainable project outcomes.

Table 32. Differences in soft skills that PE should have to deliver project success in terms of quality when grouped according to position

Success Indicator	F	Sig. (2-tailed)
Communication	1.961	.104
Problem-solving	1.057	.410
Leadership	1.210	.329
Management	1.571	.191
Teamwork	1.925	.110
Creativity	1.211	.329
Interpersonal Skills	2.417	.051

Table 32 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of quality when grouped according to position. The p-values for all the soft skills are above 0.05, indicating that there are no statistically significant differences in how various positions perceive the importance of these skills for project quality. This indicates a general consensus across all roles within the organization on the value of these soft skills in ensuring project quality, with only minor variations that are not significant enough to impact the overall agreement.

Table 33. Test of differences in the outcome variable when grouped according to position

Outcome Variable	F	Sig. (2-tailed)
Time	.710	.644
Cost	1.083	.396
Quality	.853	.540

Overall, Table 33 shows the results of testing the difference in the outcome variable when grouped according to position. For all outcome variables, the p-values are greater than 0.05, suggesting that there are no statistically significant differences in time, cost, or quality among project engineers when grouped according to their position.

Table 34. multiple comparison tests according to position

Dependent Variable	I	j	Mean Difference	SIG
Interpersonal Skills	Chief Engineer	District Engineer	.45833	.069
		Foreman	.54167	.094
		Material Engineer	.29167	.359
		Private Individual	.20833	.511
		Project Engineer	.79167*	.003
		Project Manager	.79167*	.017
	District Engineer	Foreman	.08333	.810
		Material Engineer	-.16667	.630
		Private Individual	-.25000	.472
		Project Engineer	.33333	.243
		Project Manager	.33333	.339
	Foreman	Material Engineer	-.25000	.533
		Private Individual	-.33333	.407
		Project Engineer	.25000	.472
		Project Manager	.25000	.533
	Material Engineer	Private Individual	-.08333	.835
		Project Engineer	.50000	.155
		Project Manager	.50000	.216
	Private Individual	Project Engineer	.58333	.099
		Project Manager	.58333	.151
	Project Engineer	Project Manager	0.00000	1.000
	Project Manager	Chief Engineer	-.79167*	.017
TIME				
Management	Chief Engineer	District Engineer	-.3333333*	.017
		Foreman	-.3333333	.060
		Material Engineer	.1111111	.519
		Private Individual	-.3333333	.060
		Project Engineer	.0555556	.677
		Project Manager	-.2222222	.202
	District Engineer	Foreman	0.0000000	1.000
		Material Engineer	.4444444*	.024
		Private Individual	0.0000000	1.000
		Project Engineer	.3888889*	.016
		Project Manager	.1111111	.556
	Foreman	Material Engineer	.4444444*	.048
		Private Individual	0.0000000	1.000
		Project Engineer	.3888889*	.046
		Project Manager	.1111111	.610
	Material Engineer	Private Individual	-.4444444*	.048
		Project Engineer	-.0555556	.768
		Project Manager	-.3333333	.133
	Private Individual	Project Engineer	.3888889*	.046
		Project Manager	.1111111	.610
	Project Engineer	Project Manager	-.2777778	.147
COST				
Communication	Chief Engineer	District Engineer	-.3333333	.116
		Foreman	-.2222222	.410
		Material Engineer	.4444444	.105
		Private Individual	-.3333333	.219
		Project Engineer	.3888889	.069
		Project Manager	-.3333333	.219
	District Engineer	Foreman	.1111111	.705
		Material Engineer	.7777778*	.012
		Private Individual	0.0000000	1.000
		Project Engineer	.7222222*	.005
		Project Manager	0.0000000	1.000
	Foreman	Material Engineer	.6666667	.057
		Private Individual	-.1111111	.743
		Project Engineer	.6111111*	.044
		Project Manager	-.1111111	.743

	Material Engineer	Private Individual	-.7777778*	.028
		Project Engineer	-.0555556	.850
		Project Manager	-.7777778*	.028
	Private Individual	Project Engineer	.7222222*	.019
		Project Manager	0.0000000	1.000
	Project Engineer	Project Manager	-.7222222*	.019
Problem-solving	Chief Engineer	District Engineer	-.1250	.509
		Foreman	-.1250	.609
		Material Engineer	.2083	.396
		Private Individual	-.1250	.609
		Project Engineer	.7083*	.001
		Project Manager	-.1250	.609
	District Engineer	Foreman	0.0000	1.000
		Material Engineer	.3333	.218
		Private Individual	0.0000	1.000
		Project Engineer	.8333*	.001
		Project Manager	0.0000	1.000
	Foreman	Material Engineer	.3333	.284
		Private Individual	0.0000	1.000
		Project Engineer	.8333*	.004
		Project Manager	0.0000	1.000
	Material Engineer	Private Individual	-.3333	.284
		Project Engineer	.5000	.069
		Project Manager	-.3333	.284
	Private Individual	Project Engineer	.8333*	.004
		Project Manager	0.0000	1.000
	Project Engineer	Project Manager	-.8333*	.004
Management	Chief Engineer	District Engineer	-.3333333*	.030
		Foreman	-.3333333	.087
		Material Engineer	.3333333	.087
		Private Individual	-.3333333	.087
		Project Engineer	.1666667	.262
		Project Manager	-.2222222	.247
	District Engineer	Foreman	0.0000000	1.000
		Material Engineer	.6666667*	.003
		Private Individual	0.0000000	1.000
		Project Engineer	.5000000*	.006
		Project Manager	.1111111	.594
	Foreman	Material Engineer	.6666667*	.009
		Private Individual	0.0000000	1.000
		Project Engineer	.5000000*	.022
		Project Manager	.1111111	.644
	Material Engineer	Private Individual	-.6666667*	.009
		Project Engineer	-.1666667	.425
		Project Manager	-.5555556*	.027
	Private Individual	Project Engineer	.5000000*	.022
		Project Manager	.1111111	.644
	Project Engineer	Project Manager	-.3888889	.069
Teamwork	Chief Engineer	District Engineer	-.4166667	.066
		Foreman	-.4166667	.149
		Material Engineer	.3611111	.209
		Private Individual	-.4166667	.149
		Project Engineer	.2500000	.261
		Project Manager	-.3055556	.286
	District Engineer	Foreman	0.0000000	1.000
		Material Engineer	.7777778*	.017
		Private Individual	0.0000000	1.000
		Project Engineer	.6666667*	.013
		Project Manager	.1111111	.721
	Foreman	Material Engineer	.7777778*	.037
		Private Individual	0.0000000	1.000
		Project Engineer	.6666667*	.039

		Project Manager	.1111111	.757
	Material Engineer	Private Individual	-.7777778*	.037
		Project Engineer	-.1111111	.721
		Project Manager	-.6666667	.071
	Private Individual	Material Engineer	.7777778*	.037
		Project Engineer	.6666667*	.039
		Project Manager	.1111111	.757
	Project Engineer	Project Manager	-.5555556	.082
Interpersonal Skills	Chief Engineer	District Engineer	-.25000	.157
		Foreman	-.08333	.710
		Material Engineer	.16667	.459
		Private Individual	-.25000	.269
		Project Engineer	.45833*	.012
		Project Manager	.16667	.459
	District Engineer	Foreman	.16667	.498
		Material Engineer	.41667	.097
		Private Individual	0.00000	1.000
		Project Engineer	.70833*	.001
		Project Manager	.41667	.097
	Foreman	Material Engineer	.25000	.380
		Private Individual	-.16667	.557
		Project Engineer	.54167*	.034
		Project Manager	.25000	.380
	Material Engineer	Private Individual	-.41667	.148
		Project Engineer	.29167	.240
		Project Manager	0.00000	1.000
	Private Individual	Project Engineer	.70833*	.007
		Project Manager	.41667	.148
	Project Engineer	Project Manager	-.29167	.240

Table 34 shows the results of multiple comparison tests according to position, chief engineers rate project engineers higher than project engineers rate themselves in terms of interpersonal skills. This conclusion is supported by pairwise comparison between chief engineers and project engineers, showing a mean difference of 0.79167 with a significance level of 0.003. A positive mean difference indicates that chief engineers rate project engineers higher on average, and the significance level being less than .05 suggests that this difference is statistically significant. Therefore, chief engineers tend to perceive project engineers as having stronger interpersonal skills compared to how project engineers perceive themselves.

Moreover, chief engineers rate project engineers higher than project managers rate project engineers on the characteristic of interpersonal skills. This conclusion is based on the pairwise comparison between chief engineers and project managers, where the mean difference is .79167 and the significance level is .017. This statistically significant result suggests that chief engineers perceive project engineers as having stronger interpersonal skills compared to how project managers perceive them.

The multiple comparison tests reveal notable differences in how various roles perceive the importance of the different soft skills in project success. Chief and district engineers value management skills, particularly in terms of time, more than project and material engineers, with district engineers consistently rating communication, problem-solving, and management higher. Foremen and private individuals also rate soft skills more favorably than project engineers, while material engineers generally assign the lowest importance. Project engineers tend to rate most soft skills lower than other roles, especially when compared to district engineers and private sector respondents.

Test of Difference Between Project Type and Soft Skills

Table 35. Differences in PE soft skills when grouped according to project type

Success Indicator	F	Sig. (2-tailed)
Communication	.934	.403
Problem-solving	1.061	.358
Leadership	1.367	.269
Management	3.577	.039
Teamwork	1.856	.172
Creativity	4.400	.020
Interpersonal Skills	1.784	.184

Table 35 shows the analysis of the difference in soft skills of the project engineers when grouped according to project type. It shows a significant difference in management and creativity ($p < 0.05$) but no significant differences in other soft skills. The significant difference in management and creativity skills of project engineers across different project types reflects the varied technical requirements, risk profiles, innovation opportunities, client expectations, and project complexities. These factors drive engineers to develop specialized skills and creative strategies suited to their specific sector, promoting effective project execution and stakeholder satisfaction.

Table 36. Differences in soft skills that PE should have to deliver project success in terms of time when grouped according to project type

Success Indicator	F	Sig. (2-tailed)
Communication	.831	.445
Problem-solving	.799	.458
Leadership	1.506	.237
Management	.934	.403
Teamwork	1.222	.308
Creativity	.878	.425
Interpersonal Skills	1.951	.158

Table 36 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of time when grouped according to project type. For all the soft skills listed, the p-values are well above 0.05, indicating no statistically significant differences in their perceived importance for managing project time across different types of projects. The consistency in the perceived importance of soft skills for timely project delivery across different project types suggests that training and development programs focusing on these skills are universally applicable for time management. This indicate that project type does not significantly impact the value placed on these skills, supporting the development of training programs that emphasize their importance for ensuring on-time project completion across various sectors.

Table 37. Differences in soft skills that PE should have to deliver project success in terms of cost when grouped according to project type

Success Indicator	F	Sig. (2-tailed)
Communication	1.165	.324
Problem-solving	1.687	.201
Leadership	1.345	.274
Management	.779	.467
Teamwork	1.193	.316
Creativity	.833	.444
Interpersonal Skills	1.469	.245

Table 37 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of cost when grouped according to project type. For all the soft skills assessed, the p-values are above 0.05. This means there are no statistically significant differences in their perceived importance for cost management across different project types. The lack of significant differences in the perceived importance of soft skills for cost management across project types indicates that these skills are universally valued for cost control in project management. Project engineers consider them equally important for managing costs, regardless of project type, suggesting that training and development initiatives can focus on these skills broadly, without needing adjustments based on project specifics.

Table 38. Differences in soft skills that PE should have to deliver project success in terms of quality when grouped according to project type

Success Indicator	F	Sig. (2-tailed)
Communication	2.301	.116
Problem-solving	1.500	.238
Leadership	2.160	.131
Management	1.931	.161
Teamwork	1.703	.198
Creativity	2.432	.103
Interpersonal Skills	2.444	.102

Table 38 shows the results of testing the difference in the soft skills that project engineers should have to deliver project success in terms of quality when grouped according to project type. For all the soft skills assessed, the p-values are above 0.05. This means there are no statistically significant differences in their perceived importance for quality management across different types of projects. The lack of significant differences suggests that the perceived importance of these soft skills for delivering high-quality project outcomes remains consistent across different project types. The lack of significant differences in the perceived importance of soft skills for delivering high-quality project outcomes across project types suggests these skills are universally valued for quality assurance in project management. Training programs can be broadly applicable, benefiting project engineers across various projects. While all skills are important, slight variations in the importance of communication, creativity, and interpersonal skills may warrant more tailored development efforts. Overall, these findings emphasize the consistent recognition of these soft skills' role in ensuring project quality, regardless of project type.

Table 39. Test of differences in the outcome variable when grouped according to project type

Outcome Variable	F	Sig. (2-tailed)
Time	1.222	.308
Cost	2.167	.131
Quality	.569	.572

Overall, Table 39 shows the results of testing the difference in the outcome variable when grouped according to project type. For all outcome variables, the p-values are greater than 0.05, suggesting that there are no statistically significant differences in time, cost, or quality among project engineers when grouped according to the type of project.

Table 40. Multiple Comparison Test according to project type

Dependent Variable	I	J	Mean Difference (I-J)	Sig.
Management	Flood Control	Road Concreting	.5277778*	.015
		School Building	.3888889	.066
	Road Concreting	School Building	-.1388889	.502
Creativity	Flood Control	Road Concreting	.5000*	.015
		School Building	.5000*	.015
	Road Concreting	School Building	0.0000	1.000

Table 40 shows the results of multiple comparison according to project type flood control projects place a significantly higher importance on management skills compared to road concreting projects. However, no significant difference in the importance of management skills is observed between flood control and school building projects or between road concreting and school building projects.

Flood control projects value creativity skills significantly more than both road concreting and school building projects. However, no significant difference is found between road concreting and school building projects in terms of the importance of creativity skills.

CONCLUSIONS

Based on the results of this study, the following conclusions were determined. The balance of soft skills across groups is imperative to achieve project outcomes. By ranking alone, management and leadership skills lead all soft skills to be possessed by project engineers during construction to succeed in terms of time, cost, and quality of the project. However, the findings show the need to enhance these skills across groups in ISDEO, which can be made as references for employment and skills development. Since no significant differences were found when respondents were grouped according to profile, improving skill sets is crucial in general. Enhancing soft skills among project engineers enhances communication, strengthens team collaboration, improves stakeholder management, enhances problem-solving abilities, optimizes time and resource management, fosters adaptability, and boosts client satisfaction. These cumulative benefits lead to better project outcomes, including increased efficiency, reduced risks, and successful project delivery within scope, schedule, budget, and quality parameters.

RECOMMENDATIONS

The findings of this research were limited to apply to ISDEO project engineers. The following recommendations were made: (1) Evaluating the current soft skills of personnel and staff is relevant in assessing their efficiency in construction projects. This insight suggests opportunities for ISDEO to empower project engineers through seminars, training, and workshops

that can impact their soft skills. (2) Given the collaborative nature of construction projects, future studies should include a broader range of respondents to assess the soft skills of all involved personnel. (3) Increasing the number of projects per type may change the respondent's overall responses hence the statistical analyses to be performed. (4) The methodology used in this research may be applied in other agencies to assess and improve soft skill gaps.

The researcher recommends further study of this research to verify, confirm, and improve the results of this study.

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