

Managing in A Global Environment: The Management Skill Challenges Professional Engineers Experience

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Abstract: An increasing number of new businesses, technologies, and products are emerging, all undergoing rapid and continuous transformation. Collectively, these changes have created a new paradigm in global business, particularly intensifying competition within the engineering sector. In response to globalization and heightened market competition, companies have recognized the need for engineers at all levels who can work effectively in cross-functional and multicultural teams, possess leadership or managerial capabilities, and understand the broader business and societal implications of engineering decisions.

Regardless of their area of specialization, engineers are finding that a successful career increasingly requires them to take on complex responsibilities that demand strong leadership skills. Their work now relies heavily on understanding and managing interactions across diverse domains—such as design, quality, sustainability, product planning, organizational behavior, people management, teamwork, and finance.

The aim of this thesis is to explore the concept of engineering leadership, identify and understand the skills challenges engineers face in today's highly competitive global environment—particularly as they transition into managerial roles—and propose solutions or guidance to help mitigate these challenges.

I. Introduction

Background

Engineering is the practical application of mathematical and scientific principles, combined with expertise, common sense, and sound judgment, to the design, analysis, and operation of structures, equipment, and systems. As noted in the 1986 annual report of the Accreditation Board for Engineering and Technology, engineers make the previously unimaginable possible.

The field is further defined as “the profession in which knowledge of mathematics and natural sciences, acquired through research, experience, and practice, is applied with judgment to develop methods for the economical utilization of the materials and forces of nature for the benefit of mankind.” (Tougwa, 2020). Engineers are tasked with using science, mathematics, and creativity to solve technical problems. According to Lumsdaine et al. (1999), engineers should exhibit analytical, mathematical, technical, logical, and critical-thinking traits—characteristics typically associated with an analyst's mindset.

However, the modern practice of engineering has undergone a significant transformation. Engineers must now consider sociological, environmental, economic, and political factors in the design, implementation, and operation of engineering projects. This shift reflects broader changes in the professional landscape, where traditional claims to expertise based solely on academic credentials are increasingly challenged by rapid societal evolution and a complex global environment (Galloway & Dunlop, 2007).

Although the impact of these changes may vary across different countries, the global context in which engineers operate now involves a multitude of overlapping influences. The justification for professional action is no longer based solely on technical merit—it must also be socially and environmentally accountable.

This evolving context compels engineers to reassess their civic and professional responsibilities. The engineering profession must align with these broader societal expectations. Furthermore, with public understanding of the engineer's role diminishing, the profession faces a critical leadership challenge. As Grigg (2018) points out, this is the leadership challenge confronting engineers today

Do Engineers Prepared well for Leadership roles?

It is noteworthy that as early as 1993, surveys indicated that the majority of engineers transitioned into managerial roles within three to five years after graduation (Lyons et al., 1993). Lyons observed that “management responsibilities for engineering professionals are an inevitable component of working in modern commercial sectors.” This underscores the growing need for engineers to possess not only technical expertise but also leadership and management skills.

While it is widely acknowledged that modern engineers must be equipped with a broad skill set—including technical, business, leadership, and management capabilities—the traditional engineering education system has largely focused on the development of technical knowledge. As a result, many engineering graduates are inadequately prepared to meet the demands of the workplace upon entering the profession (Katz, 1993). Since the 1990s, industry leaders have repeatedly urged academic institutions to better

integrate leadership development into engineering education. In the context of this thesis, "leadership skills" refer to competencies such as business process understanding, communication, and foundational management concepts.

A 1995 survey conducted by the American Society for Engineering Management (ASEM) identified leadership as the most significant gap between organizational expectations and the preparedness of newly hired engineers (Farr et al., 1997). This persistent skills mismatch highlights the urgency of developing leadership capabilities in future engineering professionals.

To remain competitive in an increasingly automated world, professionals must cultivate talents that machines and artificial intelligence cannot replicate. Skills such as leadership, collaboration, and emotional intelligence will only grow in value. Merely possessing technical proficiency is no longer sufficient in the modern workforce.

In fact, a 2017 Harvard study examining labor market trends in the United States between 1980 and 2010 found a 3% decline in jobs requiring high mathematical ability but low social skills. In contrast, there was a 7.4% increase in positions demanding both high mathematical and high social skills, reflecting a clear shift in employer priorities.

Similarly, LinkedIn's 2018 Global Workplace Learning Report revealed that CEOs identified soft skills—particularly leadership, communication, and teamwork—as their top learning and development priority. This further reinforces the critical role of soft skills in shaping successful engineering careers in today's dynamic and collaborative work environments.

Thesis Aim

This study aims to investigate the competitive and evolving nature of engineering in a global economy, while considering the difficulties and challenges Professional Engineers face when assuming a managerial or leadership position, and lastly, how to address these difficulties.

Thesis Objectives:

In consideration of the objectives of this thesis, we will be considering the following:

What is the Leadership Concepts within the Engineering Profession in a competitive global environment?

What the Skills Challenges Professional Engineers face in their work as they also take up Leadership and or Managerial roles?

How to mitigate and or eliminate these Leadership skills challenges for Professional Engineers

Delimitation:

This thesis aims to identify and examine some of the key leadership challenges currently facing the engineering profession. While a review of relevant journal articles and the use of online surveys or questionnaires with a selected group of engineering professionals will support and validate certain claims, this approach may limit the scope of the study. Specifically, it may not fully capture other critical challenges that are either underrepresented in existing literature or that could have a more profound impact on engineering leadership roles.

To uncover these additional challenges—especially those that significantly influence engineering professionals in leadership positions—future research should incorporate more direct, in-depth methods such as one-on-one interviews and face-to-face surveys. These qualitative approaches can provide richer insights and may reveal overlooked or nuanced issues that structured online surveys, with their time constraints and predefined response options, are less likely to uncover.

II. The Methodology:

This thesis adopts an empirical research approach that integrates both qualitative and quantitative methods. Primary data will be collected through direct online questionnaires distributed to a sample group of engineers based in Nigeria. The data retrieved from these responses will be systematically reviewed and compared with findings from previous qualitative studies conducted in other parts of the world. This comparative approach is intended to provide a broader understanding of leadership challenges within the global engineering landscape.

Secondary data will be gathered through a structured review of relevant literature, using strict, explicit, and replicable techniques to answer key research questions (Budgen et al., 2007). A comprehensive set of keywords was developed and applied across various academic databases and search engines. Titles, abstracts, and conclusions of peer-reviewed articles were reviewed to explore the core objectives of this thesis:

What are the key leadership concepts within the engineering profession in a competitive global environment?

What skills challenges do professional engineers face in the workplace, particularly as they transition into leadership or managerial roles?

And how can these identified challenges be mitigated or eliminated?

In addition to the primary data gathered via online survey links shared through email, WhatsApp groups, and LinkedIn, secondary data sources were carefully selected. Preference was given to open-access and peer-reviewed journals relevant to the field of engineering and leadership. Considerable effort was made to include a diverse range of materials, and the search process was repeated to ensure the inclusion of recent and impactful publications from both scientific and business perspectives.

To ensure broad coverage of national and international research outputs—including scientific papers, white papers, conference proceedings, and open-access resources—academic platforms such as Google Scholar, Microsoft Academic, and ScienceDirect were utilized. These tools played a critical role in assembling the literature and framing the findings presented in this thesis.

In the next chapter, we will examine the journey of engineering professionals into leadership roles, along with definitions of key terms relevant to this study.

III. Literature Review

This chapter provides a critical overview of scholarly works relevant to this research. To determine the significance and scope of the study, it is essential to synthesize and evaluate existing research on the challenges engineers face in managing and exercising leadership. The literature review serves not only to contextualize the research problem but also to position this study within the broader academic discourse.

As Creswell and Tashakkori (2007) emphasize, qualitative research requires a thorough review of existing literature to clarify the nature of the issue and to situate the study within the wider body of knowledge. Similarly, Stone et al. (2008) note that a literature review conducted at the onset of a research project establishes the foundation for inquiry. It aids in the formulation of research questions, provides a framework for investigation, and helps to identify gaps in the existing literature that the current study seeks to address.

The review encompasses a wide range of sources, including peer-reviewed scholarly articles, books, reputable trade journals, academic conference proceedings, and published industry reports. These materials collectively inform the background of the research and offer valuable insights into the evolving intersection of engineering and leadership.

Engineering and Engineers' Profile

According to the UNESCO report (2010), engineering encompasses the study, practice, profession, and art of acquiring, developing, and applying technical, scientific, and mathematical knowledge for the understanding, design, development, invention, and use of materials, equipment, structures, systems, and processes for specific purposes.

Engineers are individuals with formal engineering training or practical experience. They may hold professional titles and certifications such as *Professional Engineer*, *Chartered Engineer*, or *Incorporated Engineer*, depending on national or regional licensing and regulatory frameworks.

Engineering is a broad field that includes a wide range of disciplines and career levels. These include practicing engineers, professional and consulting engineers, engineering technologists, and technicians. Within academia, university-based engineers often focus on research and teaching in areas commonly referred to as the *engineering sciences*, as distinct from practical engineering. However, these distinctions are fluid. The definition of what constitutes an engineer continues to evolve, and there is often significant overlap, as many individuals engaged in engineering sciences also participate in practice and consulting.

Globally, the classification of engineering qualifications and professional roles varies. However, many countries organize engineering professions into three general categories:

Engineer

Engineering Technologist

Engineering Technician

These classifications are typically governed by national regulatory bodies or professional associations, which oversee education standards, professional development, and licensing requirements.

Engineering Professional Tracks

According to the UNESCO Report (2010), the "Engineer" track is typically designed for individuals who will:

- Provide technical, commercial, and managerial leadership;
- Maximize the application of both existing and emerging technologies by integrating broad and specialized technical knowledge;
- Perform tasks that are predominantly intellectual and require judgment and decision-making;
- Analyze and solve engineering problems using both theoretical and practical methodologies;

- Proactively manage the significant risks associated with engineering systems, tools, procedures, and infrastructure.

In contrast, the "Engineering Technologist" track is generally intended for individuals who will:

- Actively contribute to the development of cost-effective systems and engage in financial, legal, and commercial considerations;
- Apply independent technical judgment at an appropriate level;
- Design, develop, produce, commission, operate, and maintain equipment, services, products, and processes;
- Take responsibility for managing resources and/or supervising technical personnel, either individually or as part of a team;
- Manage moderate levels of risk related to engineering systems, infrastructure, tools, and procedures.

The "Engineering Technician" pathway is primarily aimed at those engaged in the practical application of established engineering methods to solve real-world problems. Engineering Technicians typically:

- Apply creativity and technical skills within specific areas of technology;
- Contribute to the development, production, installation, maintenance, or repair of products, equipment, systems, or services;
- Exercise technical or managerial authority in relevant contexts;
- Design and implement safe working practices.

In addition to the UNESCO classifications, experts from Duke University in the United States offer a slightly different perspective on engineering roles, categorizing engineers into two distinct groups:

Dynamic Engineers: Individuals who possess strong abstract thinking, teamwork capabilities, interpersonal communication skills, and the ability to apply scientific knowledge to complex challenges. These engineers often work across disciplinary and geographic boundaries and are key drivers of innovation.

Transactional Engineers: Individuals with foundational engineering knowledge but limited experience or ability to apply that knowledge to solve complex, real-world problems.

According to Duke University, one of the primary differences between these two types lies in their educational backgrounds. Most Dynamic Engineers hold at least a four-year engineering degree from a nationally accredited institution. Transactional Engineers, on the other hand, often possess sub-baccalaureate qualifications, such as associate degrees, technical diplomas, or certificates obtained over one to three years.

However, the UNESCO report (2010) also emphasizes that formal education is not the sole determinant of success. Over the past five decades, numerous influential leaders in science and technology have emerged with little to no formal education, highlighting the importance of practical experience, innovation, and adaptability in the engineering profession.

Requirements for Engineers to become Successful Managers

According to Hercules et al. (2004), the only way to ensure career progression and personal development for engineers entering industry, commerce, or government service is by cultivating a broad understanding of the commercial, financial, and accounting aspects of business operations. Project managers, in particular, are expected to work primarily through collaboration with others, adopt a cross-functional perspective, and demonstrate a stronger identification with the project itself rather than their original area of expertise.

The challenges engineers face—such as financial management, legal responsibilities, and personnel oversight—are often similar to those encountered by business professionals. However, the engineering role is unique in that it also carries distinct technical responsibilities in addition to managerial duties.

Given this context, acquiring the necessary business education and experience to advance into higher managerial positions becomes increasingly difficult. Skilled engineers are often perceived as irreplaceable within their technical domains, leading to a form of professional confinement. This perception can result in engineers becoming narrowly specialized, limiting their ability to transition into broader leadership roles. Hercules et al. (2004) note that this trend is especially pronounced in the United Kingdom when compared to other European countries.

Work experience as a requirement

Engineers who struggle in managerial roles often do so due to a lack of essential knowledge and expertise beyond their technical training. As Wearne (1994) argues, engineers must adopt a broader perspective to succeed, particularly when transitioning into project management roles. One of the most challenging areas for engineers to develop is people management, as interpersonal skills

are typically less emphasized—and often undervalued—in the roles of individual technical contributors. However, as engineers gain more experience and begin to understand how their actions fit within the broader organizational context, their likelihood of succeeding in leadership positions increases.

To build this broader perspective, McAlister et al. (1984) recommend that engineers engage in a variety of roles, participate in technical societies and committee work, and cultivate a natural curiosity about the larger context of their professional activities. These experiences not only enhance their understanding of organizational dynamics but also prepare them for greater leadership responsibilities. Similarly, Bircumshaw (1980) emphasizes that the ultimate aim of project management training should be to optimize career advancement for individuals who demonstrate the potential to take on increased responsibility.

Technical skills as requirement

According to Thamhain (1983), it is essential for engineering professionals to possess not only technical skills but also a solid understanding of market dynamics and the broader business environment. Engineering managers, in particular, must have substantial technical expertise to effectively lead project teams and equip them with the interdisciplinary knowledge required for success.

Interestingly, consultants who lack business acumen are more prone to failure than those who lack technical proficiency. While increasing technical complexity continues to give science and engineering a competitive edge, this does not necessarily mean that senior executives must have deep technical knowledge. Instead, it implies that leaders in technology-driven industries should possess a certain level of technical understanding as part of their *cultural literacy*. As noted by Hercules et al. (2004), the term *cultural* encompasses the collective knowledge and experience an individual uses to draw meaningful conclusions and make informed decisions.

In sectors where rapid technological advancement is critical for survival, managers are expected to maintain a high level of technical competence. This trend is anticipated to continue, as industries become increasingly reliant on leaders who can bridge the gap between engineering innovation and strategic business thinking.

Interpersonal skills as a requirement

Engineers are often more focused on facts than emotions, logic over intuition, and objects rather than people. This cognitive orientation can limit their effectiveness in managerial roles. As Bircumshaw (1980) notes, many engineers lack sensitivity in people management, and their frustration with the seemingly illogical or inconsistent behavior of subordinates often highlights this gap. Sedge (1985) further explains that engineers, who are typically trained to work with systems and processes, may not have developed the interpersonal skills required for success in people-centered roles. He emphasizes that traditional management training often falls short in supporting engineers through this transition and recommends improved selection and training practices to bridge the gap.

Hercules et al. (2004) observe that many engineers maintain a skeptical attitude toward people management training. This skepticism stems from their educational background and problem-solving mindset, which tends to favor data, precision, and definitive answers—qualities not often found in the domain of soft skills. People management topics typically address "soft" issues where answers are nuanced rather than clear-cut, a style that contrasts with the engineer's preference for hard data and binary conclusions.

As engineers move into leadership roles or larger project environments, interdisciplinary skills become increasingly vital. While a manager's network expands with career progression, engineers must also learn to navigate broader organizational challenges. Lannes (2001) highlights that success in these contexts requires not only technical expertise but also competencies in project management, interpersonal communication, and a working knowledge of finance, marketing, and organizational behavior.

When companies hire new supervisors, they prioritize candidates who demonstrate the ability to collaborate effectively with diverse individuals. Engineering work is often team-based, and engineers must coordinate closely with peers and superiors to achieve shared goals. An engineer's success is intrinsically linked to team performance. Engineers who attempt to work in isolation are often less effective and may experience dissatisfaction in modern workplaces. McAlister et al. (1984) affirm that recognizing a team's role in individual success can significantly contribute to professional growth.

Obiajunwa (2013) outlines several key attributes that managers must cultivate to foster high-performing engineering teams:

- Strong commitment from team members;
- Effective teamwork and positive interpersonal relationships;
- Access to essential resources and knowledge;
- Clearly defined project goals and objectives;
- Supportive and engaged top management;
- Robust project management structures;

- Clear and open communication at all levels;
- Effective conflict resolution mechanisms;
- Emphasis on professional development;
- Broad organizational support for project initiatives.

Hercules et al. (2004) also highlight communication as a critical factor in career advancement. One executive responsible for over 100 engineers stated, “When we interview engineering graduates, we consider the ability to communicate to be as important as grade point average.” Even if a new engineer possesses only average technical competence, their performance may be judged heavily by how they present themselves in meetings and on phone calls.

Bircumshaw (1980) adds that newly hired engineers typically require structured training before they can contribute effectively in operational roles. Hiring decisions are often based on indicators of potential—such as intellectual maturity and leadership ability—rather than immediate technical readiness. However, strong academic performance does not necessarily equate to proficiency in environments with high levels of interpersonal interaction. In many cases, engineers must rely heavily on communication tools, such as the telephone, to resolve complex issues—a task that requires well-developed interpersonal skills

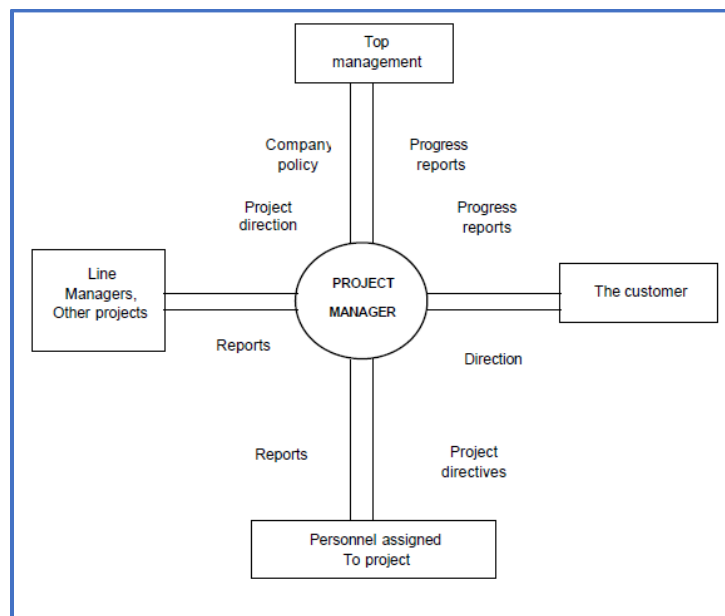


Figure 1. The project Manager skills Links (Source: Adapted from: Bennett (1996 p.10.)

So it's important to have good verbal communication skills and abilities. Obviously, shortcomings here will reduce opportunities.

The management team must also be open to accommodating individual differences and long-term transformation. As seen in figure 1.1 above, an engineer entering the managerial arena will also join the managerial skills mix arena, which shows the relationships between the various communication abilities.

In technological organizations, project managers are frequently expected to interact in a crucial fourth direction: outside the organization. Although interacting with the general public via new media, public testimony, speeches before citizen organizations, and similar activities may fall under the purview of this activity, the customer will be the primary stakeholder. An engineering project manager needs to have effective communication channels, as shown in Figure 1.1.

(Sedge, 1985) asserts that it is feasible for an engineer to never have developed the interpersonal skills required to function in a "people-oriented" capacity when performing a role with a "thing" or "data" orientation. (Sedge, 1985) indicate that enhanced selection and training techniques are necessary to speed up the transition process because the majority of management training falls short of meeting the demands of individuals who are in transition.

Engineers Leadership Work Challenges

Many engineers first encounter team leadership in a state of unpreparedness—akin to being suddenly thrown into deep water without a life jacket. Opting for the path of least resistance in leadership situations often results in missteps, discouragement, and strained relationships with colleagues. While some individuals have natural leadership inclinations, most engineers do not. As a result, leadership development becomes a critical yet frequently overlooked area of professional growth.

It is evident from the foregoing that modern engineers require far more than technical expertise. Today's engineer must also understand business processes, collaborate effectively within cross-functional teams, and possess the interpersonal or "soft" skills necessary to communicate with colleagues, superiors, and subordinates—both locally and globally.

Fortunately, many leadership competencies can be learned and developed over time. These foundational skills, once mastered, significantly improve an engineer's ability to avoid common pitfalls and succeed in career paths increasingly dependent on leadership capacity (Hess, 2018). While engineers receive rigorous training in the theoretical and practical aspects of their disciplines, their formal education offers limited exposure to leadership theory or its real-world application. Teamwork experience is often minimal and primarily technical in nature.

Upon entering the workforce, engineers are commonly placed within teams, sometimes unexpectedly assuming leadership roles. In these settings, they are expected to use their technical expertise to solve complex problems—many of which lack clear solutions or guidance. Effective leadership in such contexts involves creating shared visions, setting goals, fostering collaboration, and communicating decisions clearly. Leaders are the catalysts for completing these tasks successfully. As Hess (2018) emphasizes, leadership that fosters collaboration, synergy, and creativity is essential to translating knowledge into practical outcomes.

Despite this, soft skills such as communication, negotiation, influence, and emotional intelligence are seldom prioritized in traditional engineering curricula. New graduates are often thrust into leadership roles without adequate preparation, facing the immediate challenge of motivating and guiding teams. This results in frustration and performance gaps for many novice leaders.

Research indicates that over 50% of engineers report occupying managerial roles, and engineers are a major source of executive leadership within UK companies. Therefore, engineers' managerial competence is of national importance. Studies in UK manufacturing have found that even engineers not formally in management roles must effectively communicate, organize information, supervise teams, and navigate labor relations. Yet, some engineers struggle to transition from the quantitative precision of physical problem-solving to the qualitative ambiguity of managerial decision-making. This difficulty may stem from differences in temperament, educational background, or insufficient training (Dudman & Wearne, 2003).

Although the supporting data in some of these studies is limited and partially subjective, it nevertheless suggests that management preparation is crucial for engineers—particularly in the UK. However, when UK mechanical engineers were surveyed about their education, many expressed a strong preference for technical depth. They viewed business-related coursework as acceptable only if it did not detract from core engineering fundamentals (Dudman & Wearne, 2003).

This tension between technical and managerial education is further compounded by structural shifts in how organizations operate. Traditional bureaucratic systems are no longer sufficient in responding to the rapid pace of change (Doyle & Van Tiem, 1993). In their place, flatter, team-based organizational models demand a new set of specialized management skills. One of the primary responsibilities of project managers is team formation—an activity that requires identifying, integrating, and aligning multiple functional units into a cohesive project structure. This demands broad managerial competencies (Hercules et al., 2004).

There is a subtle yet significant shift in the character traits now rewarded by the modern economy. As organizational expectations evolve, so too must the social and professional identities of engineers and managers. Evans and Bredin (1987) argue that engineers transitioning into management roles face a challenging task: shifting focus from solving technical problems themselves to empowering others to do so, developing emotional intelligence, and navigating internal politics—an area that is often foreign to engineers trained in logic and systems thinking (Hercules et al., 2004).

Similar Past Survey Projects

The 1979 UK Survey on Engineers Skills and Expertise' needs

The first notable survey addressing the intersection of engineering and management was conducted in the UK in 1979. It was initiated in response to an observed lack of consensus among stakeholders—educators, employers, and engineers themselves—on what managerial knowledge and skills engineers should possess, and how these competencies should be developed. Despite the time that has passed since that initial effort, reaching a unified conclusion on these questions remains difficult. This ongoing ambiguity can largely be attributed to two primary factors:

Lack of clarity regarding actual needs: While many engineers have reported feeling unprepared for the managerial aspects of their roles, there has been little detailed understanding of what they specifically mean by "management," or how those needs vary from one job function to another.

Conflicting perspectives across the industry: Divergent opinions persist. Some argue that formal training programs are incapable of transforming engineers into effective managers, while others believe engineers must at least gain exposure to topics like marketing and cost control. Much of this inconsistency may stem from the vague and often subjective use of the term "management" itself (Dudman & Wearne, 2003).

The purpose of the 1979 study was to identify the specific knowledge and skills required by chartered engineers in relation to cost control, market awareness, organizational relationships, contract administration, legal considerations, and similar functions. A

comprehensive questionnaire was distributed to 1,000 corporate members across ten engineering institutions. Approximately 49% of UK members responded to the survey, offering valuable data on the perceived gaps in managerial competence among engineers.

The findings from this and similar enquiries have highlighted how tradition and conventional thinking continue to shape UK policy on the education and training of both engineers and engineering managers. For example, criticisms are frequently made that modern engineering graduates lack practical experience in areas such as design and management—especially when compared to earlier generations educated through technical colleges or evening programs while completing craft-based apprenticeships. However, similar complaints were once made about those very predecessors, revealing a cyclical nature to these perceptions.

Overall, the lack of sustained agreement on the underlying issues or appropriate interventions may be attributed to the absence of reliable, evidence-based information about the evolving expectations and realities of engineering practice (Dudman & Wearne, 2003).

The 1983 poll conducted in Norway

The primary objective of the survey was to collect detailed information on the managerial knowledge and skills utilized by engineers in their professional roles, with the aim of informing and guiding stakeholders involved in the education and training of engineers. The Norwegian study formed part of a broader international initiative, and its findings were compared with those from similar surveys conducted in other participating countries (Solem, 1984).

At the outset of the project, three key insights were established:

There is broad consensus that the majority of engineer's transition into management roles at some point in their careers.

There is a lack of agreement on how much management education engineers should receive, and when—whether during undergraduate studies or at different stages of their careers.

There is limited understanding of the specific administrative skills required for various engineering roles and career stages (Solem, 1984).

In response to these insights, the survey was designed to identify the managerial skills, abilities, and knowledge necessary for performing tasks related to cost control, market engagement, organizational coordination, contracts, legal considerations, and similar responsibilities within engineering roles.

The study operated on the premise that different professional positions demand different managerial competencies. Depending on the responsibilities associated with a specific role, a job could be classified as primarily technical or predominantly administrative in nature.

Two main factors were identified as primary determinants of an engineer's role:

The organizational context, including the general characteristics of the company and the specific nature of the engineer's workplace.

The personal characteristics and attributes of the individual engineer.

It was therefore concluded that engineering roles are shaped both by external factors within the organization and by internal traits of the engineer himself (Solem, 1984).

The Choice of method use:

To ensure the success of the study, the researchers determined that the most effective method of investigation at the time was a postal survey. This approach allowed for broad coverage, enabling the inclusion of engineers from diverse specialties, age groups, and levels of responsibility. Considering the available time and resources, a target sample size of approximately 1,000 participants was deemed practical.

As part of the data collection process, questionnaires were sent via post to a sample of 1,002 members of the Norwegian Society of Chartered Engineers. Prior to the analysis deadline, 702 valid responses were received, resulting in an impressive response rate of 70% (Solem, 1984).

The Findings from the Survey

Some of the findings of the Norwegian poll were quite comparable to those of the engineers from Britain and other countries. Additionally, it shows when comparing statistics from various nations that:

Despite the fact that many engineers work in primarily technological fields, most of them need some administrative knowledge and skills.

The most significant differences between then and now were the relative weighting of various managerial abilities, etc. The most important skills that engineers need to have are those that pertain to managing projects and managing people at work, rather than other topics that are frequently included in management courses, across all of the countries.

Results from Australia, Canada, and the UK were strikingly comparable. The Japanese shown the most variation, although generally speaking, the same skills and other factors were crucial in each nation. (Solem, 1984).

In conclusion, the survey from Norwegian polls indicated that;

The profession of engineers does not have a clear, consistent focus. Instead, the profession should be viewed as a process with variable content.

Even though management responsibilities are a part of every engineer's career, many engineers still work in positions that are primarily technical.

Most engineers lack formal education or training in many managerial fields that are necessary for their current positions.

The type of engineering field, or the category of engineer, will determine the specific managerial skills or abilities and knowledge that are needed.

And lastly, at various stages of a career path, different managerial experience and skills are required, hence the needs vary with age. Early in an engineer's career, some managerial skills and knowledge requirements gradually go away. Later in their careers, some gain in significance. For some, mid-career is when they are most crucial. (Solem, 1984)

The 2002 Survey sponsored by SEMTA the UK Government's skills Council

Another survey was undertaken in 2002 and was backed by the Engineering Council (UK), Ten chartered engineering institutions, and SEMTA, the UK Government's sector skills council for science, engineering, and manufacturing technologies to determine how much has changed since a similar survey was conducted in 1979, and data were compared.

A questionnaire asking about the "managerial" skills and knowledge needed for their professions was sent to a sample of chartered engineers living in the UK in 2002. According to the research, most engineering occupations require a wide range of managerial skills, notably in two areas: Project management and Leadership. Some of these managerial abilities and expertise are needed early in an engineer's career, while the demands vary depending on age and amount of responsibility. (Britain)(LSC), 2004)

It was intended for the sample size to be at least 1 in 300 chartered members who were not yet retired and lived in the UK. The majority of questionnaires were distributed via postal mail, although one institution sent its survey via email to 50% of the sample's members.

A number of 227 people in total successfully completed the survey. Almost 30% of individuals who received the survey responded, which is a respectable number.

A general description of each engineer's position and qualifications was requested in the questionnaire, followed by more specific questions about the technological versus managerial content, the most challenging or time-consuming aspect of their work, the level of autonomy and authority they had, and the specific managerial skills and knowledge they needed now and in the future. The respondents were also asked about potential work changes, managerial aspirations, and the assistance they anticipated from institutions in pursuing these aspirations. They were also given the opportunity to add any general observations. (Dudman & Wearne, 2003)

The Aim of the survey

The primary objective of the study was to provide up-to-date and relevant insights to guide employers, educators, training professionals, professional institutions, regulatory bodies, government agencies, and engineers themselves in understanding the managerial skills and competencies required at various stages of an engineer's career.

Many of the findings were unsurprising—logical, consistent, and aligned with established trends. Although the study was not intended to explicitly compare results with earlier surveys, the similarities between data gathered in 1979 and 2002 support the reliability and accuracy of the findings (LSC, 2004).

One notable gap highlighted by the study is the lack of comparable surveys focused on the technical aspects of engineers' work, making it challenging to propose evidence-based changes to curricula, training programs, or professional development pathways. The survey revealed that while many engineers continue to perform primarily technical tasks, managerial responsibilities are an integral part of most career trajectories. More than 80% of respondents reported needing some form of "managerial" skill or knowledge in their roles, while only 25% indicated that their work was predominantly technical. This suggests that for the broader engineering profession—especially newly Chartered Engineers—managerial and interpersonal skills may be just as essential as technical expertise (Dudman & Wearne, 2003).

Importantly, the 2002 survey results showed that although respondents had received more training in management-related topics than their 1979 counterparts, there remained a strong desire for even greater preparation to meet future managerial demands. This underscores the need for more intentional and structured training approaches during the early stages of engineers' careers.

The study also concluded that management and technology subjects should not necessarily be taught within the same engineering courses. One rationale is that some managerial skills become relevant only later in a professional career, and by the time such responsibilities arise, the knowledge landscape may have shifted. Conversely, if management topics are not introduced during formal education, they may be inadequately developed or overlooked entirely.

Interestingly, the proportion of respondents holding advanced degrees in management increased in 2002, indicating growing recognition—among both engineers and employers—of the value of formal management education. This aligns with a broader trend observed across professional sectors: that formal study often precedes, rather than follows, real-world experience.

Part of their reviewed conclusion indicated that:

Although many engineers continue to work in positions that are primarily technological, most engineering careers require a variety of "managerial" abilities and knowledge. So, for engineers as a whole, administrative and social skills and competence may be just as crucial as technical ones, especially in terms of project management and leadership. Early on in an engineer's career, they must develop a variety of management skill. As might be expected, the demands change as people become older and become more responsible.

Early on in an engineer's career, they must develop a variety of management abilities. As might be expected, the demands change as people become older and become more responsible.

Although the needs of the members of various institutions vary to some extent, they are all similar in that they all demand knowledge and skills in project management and leadership

Engineers' employment now places a considerably greater emphasis on managerial knowledge and skills than they did in the 1979 poll. (Britain)(LSC), 2004)

Some shortfalls with the 2002 UK Poll:

The poll did not set out to determine a typical program of management studies for engineering students at various career levels. The data acquired show that there are differences in needs across the institutions' members.

It's possible that a poll with a larger sample would reveal variances between the many professions within each industry.

A further "snapshot" of the jobs at the time, the samples of each institution's membership were similarly only marginally larger. There is a need for more thorough and frequent surveys that include all of the work and future requirements of engineers at various phases of their careers. (Dudman & Wearne, 2003)

The Transition of Engineers into Management

Three interconnected factors, namely knowledge, abilities or skills, and attitudes, are responsible for engineers' smooth transition into management. For managers to succeed, it is essential to have a solid understanding of the concepts and components of administration. Yet, this information is insufficient to guarantee competency on its own.

According to (Hercules et al., 2004) while management practice is viewed as an art, management theory is viewed as a science. So a person who has acquired a set of managing skills qualifies as an effective manager. The engineer is a person who is qualified to practice engineering due to his knowledge, application of the mathematical, physical, engineering sciences, and the principles and methods of engineering analysis and design that were obtained via engineering education and experience.

There is a "correct" answer in engineering for almost every technical or scientific problem. But when it comes to the majority of managerial decisions, there is rarely a "correct" response. There are solutions that are effective but may not always be the "one-and-only" solution.

It is not necessary to always have the "one-and-only" solution to a management problem in order to be an effective manager. It involves leading the teams in productive ways that help them accomplish the operational goal. There is frequently more than one "optimal" method to handle an issue. A given circumstance may have numerous paths to the intended operational goal. The people engaged, the project risk, the amount of time involved, and the relative levels of competence of the team and the manager will all be significant considerations in determining the most effective management strategy, according to Arshad TK Online, 2011 publication.

In an environment where there has been widespread recognition of the significance of leadership and managerial skills for success in the international business environment, particularly in respect to leadership, interpersonal skills, and communication skills, to what extent have engineering and the engineering profession adjusted to these trends and responded to them in a forward-looking rather than a reactive way. In order to succeed, managers must be able to address significant political, economic, and social trends and issues, in addition to those already mentioned above. (Grigg, 2018)

These factors and trends include:

How to create plans that satisfy the demands of numerous stakeholders and constituencies.

How to keep the economy competitive in a world market.

How to handle the cultural diversity in the workforce; and

How to strike a balance between the need for economic growth and environmental protection.

The emphasis has shifted away from engineering's core values, which are to enhance quality of life and safeguard public safety, health, and welfare, even though this action served to emphasize engineering's technical components. Engineers who lack training in public policy, ethics, leadership, communication, and management are unable to provide the public with sufficient services (*Galloway, 2007: 47*).

Engineers are increasingly finding themselves leading the critical push towards sustainable engineering businesses in recent years because of the nature of their technical knowledge and education. But in recent years, university instruction has tended to rely on the expertise of engineering technology experts who have little interest in engineering business and the ensuing commercial issues of the twenty-first century. A knowledge base related to commerce and business must be incorporated into university engineering education in order for it to no longer be characterized as being "primarily scientific and technical in nature." The majority of engineering faculties have made an effort to include managerial education in their engineering curricula. They, however, are frequently seen as a 'bolt-on' to the technical skills being taught and, as a result, as a secondary issue (Childs & Gibson, 2010).

As a result, a problem exists at many engineering faculties with the way management topics are taught. In many engineering and industrial organizations, fresh graduates are unable to quickly contribute to business outcomes because they are not prepared to handle engineering management difficulties. This has led to an increase in employer unhappiness.

Because engineering is seen as a rigorous, scientific field and management is a social science discipline taught via case studies, anecdote, and other non-quantifiable methods, engineers frequently feel uncomfortable with the management components of their career. Many students choose engineering because they don't want to learn that way, which makes the issues worse. (Childs & Gibson, 2010)

It should be noted that engineers are becoming increasingly required to take on more leadership roles in society as well as in the industry, where these abilities are increasingly important. This demand is brought on by the fact that "the difficulties that engineers deal with have gotten more and more multidimensional, engaging with public policy and public perceptions, commercial and legal complexities, and government rules and regulations, among other domains. This is the inevitable outcome of technology's continued advancement in both society and politics (King, 2006).

Engineers must acquire the management and leadership abilities and or skills that business is looking for in order to feel more at ease speaking up and trying to be actively involved in politics and their communities. (Alan Wilde & Alan, n.d.)

However, it is now obvious that engineers need to combine their technical and analytical skills (Hard skills) with a thorough knowledge of what are referred to as "soft" problems that are nontechnical (Soft-skills).

The hard skills for instance are easier to define for engineers. Knowledge of science, mathematics, and applying them. But the soft skills apply to human interventions, human interrelations with human beings, and how you manage them and how you talk to them and how you respond when they communicate with you, which can be more than just speech. It can be your body language, it can be the way that you command respect through not shouting and performing but just your demeanour. (Munir, 2022)

The very demanding duties of the modern workplace, then, require that the engineers of the twenty-first century possess these necessary skills, knowledge, and values. They need technical know-how combined with expert manufacturing and development expertise, as well as the capacity to envision, build, and oversee intricate engineering systems. Also, they must be able to innovate and do work in the field of sustainable development and grasp how corporate organizations operate. They must be equipped with a strong sense of morality and social responsibility and be prepared to live, engage, communicate, and cooperate as global citizens. They must comprehend the ideas of diversity and interdisciplinary at the same time. (Munir, 2022)

What are Soft Skills?

Soft skills are often non-technical competencies needed in a particular employment situation that allow someone to deliver information or services to clients or coworkers, work well in a team, learn or acquire the technical abilities required for a job, win over management and supervisors, and comprehend and adjust to workplace culture are all required. (Walther et al., 2011)

In a context of engineering, (Galloway & Dunlop, 2007) defines soft skills as:

Consisting of the capacity to work in diverse teams; knowledge of professional and ethical responsibilities, and proficiency in communication; the comprehensive education required to comprehend the effects of engineering solutions in a national, international, economic, and societal context; the necessity for and capacity for lifelong learning; and an understanding of current concerns.

Employers need engineers in today's job market who have the necessary skill set, can communicate well, and have good interpersonal skills. These characteristics are typically required of engineers in company cultures, and the best individuals who

exhibit these qualities during the hiring process will be chosen. Nowadays, engineering is viewed as a collaborative and creative profession rather than as a single endeavor. (Munir, 2022)

Call to Action on Leadership roles

The upcoming management and leadership issues have been warned of more than once.

Examining some of the macro-trends that threaten the status quo might help us think more clearly about the expectations that will be placed on business owners, managers, and professionals in the future. What will the organizational, management, and leadership issues of the future be?

First, leaders, managers, and organizations will need to have the ability to accept and manage the growing trade-off between economic growth and resource conservation.

Second, it's likely that governments will take on new roles in their interactions with businesses, adopting a facilitative rather than an interventionist position that will place greater demands on the private sector than in the past.

Thirdly, there will be an increasing focus on quality of life and sincere requests for increased employee involvement in organizational management from the workforce.

Fourth, there will be an ever-increasing demand on managers' attention and time due to public discontent and increased public scrutiny of big business, governments, and unions. (It follows that engineers will become more and more active in dialogue with significant stakeholders as a result of their position.

The final change will come from new production technology, which will encourage smaller, more effective work environments. (Grigg, 2018)

By focusing more on managing for the future and pushing themselves outside of their comfort zones, leaders and managers will have to deal with concerns of digital disruption, changing demography, scarce resources, and transforming industrial relations frameworks.

A US company's engineering vice president was cited in year 2000 as saying, "We look for somebody who can lead a team, someone who can get a small team, four to six people, enthusiastic, and a person who can quickly discover which people are best at doing what." Finding a skilled engineer is challenging enough; finding one who can manage a team and communicate well with clients is even more challenging (Costlow, 2003).

This assertion above, is supported by the quotation made by (Farr et al., 1997): "Young technical or staff engineers must develop into leadership roles faster than their predecessors because of the changing nature of modern engineering"

Engineers are becoming increasingly required to take on more leadership roles in society as well as in the industry, where these abilities are increasingly important. This demand is brought on by the fact that "the difficulties that engineers deal with have gotten more and more multidimensional, engaging with public policy and public perceptions, commercial and legal complexities, and government rules and regulations, among other domains. (Alan Wilde & Alan, n.d.)

This is the inevitable outcome of technology's continued advancement in both society and politics (King, 2006). A startlingly small percentage of professional engineers are involved in regulatory and political issues, notwithstanding how pervasive technology is in both daily life and politics.

The question remains, that how well have engineering and the engineering profession adapted to these trends and dealt with them in a proactive manner as opposed to a reactive one in a setting where there is a widespread understanding of the value of managerial and leadership skills for success in the global business environment, particularly in regards to leadership, interpersonal skills, and communication skills.

In order to succeed, managers must be able to confront significant political, economic, and social developments, including not just those already mentioned but also:

How to develop strategies that satisfy the needs of a wide range of stakeholders and constituencies.

How to manage cultural diversity in the workforce

How to balance environmental concerns with economic growth goals.

How to maintain economic competitiveness in a global market place and

How to promote quality in the workforce (Grigg, 2018)

According to (Bowman & Farr, 2000), the now engineers must have the following skills:

- A broad education is required to comprehend the impact of engineering solutions in a global/societal context.

- Recognition of the need for, and capacity for, lifelong learning.
- Knowledge of current issues.
- Ability to work on multidisciplinary teams.
- Understanding of professional and ethical responsibility and
- Ability to communicate effectively.

The engineer must also be able to "successfully convey [his or her] vision to public participants and decision makers throughout the worldwide continuum of cultures."

The days of spending months creating a design in a cubicle and then throwing the finished product over the wall to another department are long gone. Leadership abilities are crucial for both individual and company success in the new environment, which is one of high interaction.

What is Leadership?

Given the wide range of models and descriptions that the literature has offered, it has proven challenging to define leadership in a single line or paragraph.

Leadership, in the words of Dwight D. Eisenhower, is the ability to persuade another person to carry out your instructions because they want to.

Effective leaders are:

- able to completely articulate themselves
- know what they want and why they want it
- know how to communicate that desire to others in a way that will elicit their cooperation and support and
- They also have a clear understanding of how to get what they want.
- They also provide a vision, which is a portrayal of where a company, team, or nation should strive to be in the future that is realistic, compelling, and appealing. Establishes objectives and goals, inspires and motivates others around her, controls the delivery of the vision, and can effectively manage change, and coaches and creates a team to achieve the vision. (Grigg, 2018)

Although the leader is acknowledged as an expert with expert knowledge, they are not always assumed to have all the solutions. The capacity to pose pertinent questions and look for pertinent answers is the expert knowledge being discussed here. The ability to ask the proper questions of an accountant, a lawyer, or another engineer is a must for managing multi-skilled teams, even if one is not an expert.

The majority of us learn and develop leadership qualities via work and social experiences, education, mentoring, and reflection, however some people are born with a natural flare for leadership.

Therefore, a new paradigm for engineering leadership focuses on:

- being very articulate,
- sensitive to others and the community,
- effective in diverse teams across many different organizations,
- very familiar with organization governance and
- actively engaged in continuing professional development, and very aware of local, national, and global trends.

In the next chapter, we will be going deep into the methodology as conducted in this thesis work. The use of surveys and questionnaire to draw a poll among sampled Engineers to know their thoughts and opinion as it relates to Leadership skills and related challenges within the Engineering Professionals in a competitive work environment.

IV. Methodology

Methodology Introduction

Every research effort is typically driven by a specific goal—whether to resolve a known problem, clarify a disagreement, or answer a pressing question. One of the fascinating aspects of research is its paradoxical nature: it can be intellectually stimulating and rewarding, yet also frustrating and exhausting. As DePoy et al. (1999) note, research can be both exhilarating and tedious, often requiring significant time and effort.

The primary objective of this study was to gain a deeper understanding of the core operational skills required in engineering roles, as well as the transitional skills necessary for engineers to successfully move into leadership and/or managerial positions within a highly competitive global environment. In particular, the study sought to explore the challenges professional engineers face when assuming such roles.

To achieve this, a quantitative research strategy was adopted. A structured questionnaire, consisting of both closed-ended and brief open-ended questions, was distributed to approximately 2,700 practicing engineers across various disciplines within Lagos State, Nigeria. The sample was drawn using statistical data obtained from the Lagos branch of the Council for the Regulation of Engineering in Nigeria (COREN). The questionnaire focused on the engineers' job functions, their understanding of the importance of soft skills, and the leadership challenges they encounter in their professional practice.

Potential Research Techniques

Research can be divided into two categories: Quantitative and Qualitative. To help in addressing the research issue, it is crucial to use the proper methodology. A description of each method and an explanation of why it was chosen for this research are given in the sections that follow.

Qualitative

Non-numerical research is referred to as qualitative studies. When little information is known ahead of time, qualitative investigations are typically utilized for exploratory objectives. Understanding the topic is the objective rather than measuring it. (Belcher et al., 2016).

In advance of a quantitative study, qualitative research is frequently undertaken (Talwar et al., 2011).

A qualitative technique is inadequate for this study because the goal of this research was to evaluate the skills required and the challenges engineers confront when stepping up into leadership or management roles based on a small number of previously established criteria.

Quantitative

Quantitative studies are numerical in nature and are performed to assess the topic matter. Because the outcomes are frequently numerical, they lend themselves well to statistical analysis. "The main goal of conducting a quantitative study is to be able to generalize - that is, to be able to draw conclusions from a small subset of a larger group that will apply to the entire group" (Belcher et al., 2016).

Surveys and historical data sources are the two main strategies for gathering quantitative data, but we will expand a little more on the survey aspect.

Surveys

In today's world, surveys are commonplace. While defining a survey succinctly can be challenging, there are three common central characteristics of surveys (Talwar et al., 2011):

- Choosing representative samples of people from established communities.
- the use of a quantitative, fixed design and,
- The gathering of a little amount of data in a consistent format from a significant number of people.

There are many exceptions to features one and two, despite the fact that this is a good generalization. Studies that are descriptive or explanatory can benefit from surveys. For exploratory purposes, they are not very suitable.

There are two ways to carry out surveys: **Self-administration and Interview**. A useful list of advantages and disadvantages for each form of survey, and for surveys in general is provided by Robson (Talwar et al., 2011).

Disadvantages

General to all questionnaires with responders

- The respondents' personal traits (such as their memory, expertise, experience, motivation, and personality) have an impact on the data.
- Respondents won't always fully reflect their opinions, views, etc. (e.g., there is likely to be a social desirability response bias, where people reply in a way that puts them in a good light).

Self-administered surveys

- Typically get little responses. You typically don't know the characteristics of non-respondents; therefore, you don't know how representative it is.

- It may be difficult to identify ambiguities and misinterpretations in the survey questions.
- It's possible that respondents won't take the exercise seriously, and you might not be able to tell.

Interviews surveys

- Interviewer traits, such as motivation, attitude, abilities, and experience, could have an impact on the data. There may be interviewer bias, in which the interviewer influences the responses (for example, through verbal or non-verbal signals indicating "right" answers"), very likely unintentionally.
- The qualities of the interviewer and the responder (such as whether they are from the same or a different class or ethnic background) may interact to alter the data.
- Participant may be less open if they believe their replies are not anonymous

Advantages

General to all questionnaires with responders

- They offer a rather easy and direct method for studying attitudes, values, beliefs, and motives.
- They may be modified to gather data that can be generalized from practically any human population.
- There is extensive data standardization.

Self-administered surveys

- In many cases, this is the only or simplest method of getting information about the former lives of a big group of people.
- They are capable of delivering massive amounts of data quickly and efficiently at a low price.
- They permit anonymity, which may encourage candor in discussions on sensitive topics.

Interviews survey

- The interviewer can provide more information.
- The interviewer's presence stimulates involvement and participation (vice versa).

Chosen Research Method

To gather data from a large population of engineers and analyze relationships between various variables and engineer characteristics, this study employed a quantitative, self-administered online survey method. The self-administered approach was chosen both to suit the nature of the questions and to minimize time constraints for both respondents and the researcher.

The survey questions were carefully designed to be clear and straightforward, minimizing any potential bias or influence on the engineers' responses. The online format allowed participants to complete the survey at their convenience, which facilitated the collection of a substantial amount of data within a short timeframe.

Survey Population and Administration

The Council for the Regulation of Engineering in Nigeria (COREN) is a statutory body set up by the Federal Government of Nigeria with the mandate to regulate the practice of Engineering in all aspects and ramifications.

According to the statistical data from the Council for the regulation of Engineering in Nigeria (COREN), there are about 2,700 registered Engineers in Lagos state of Nigeria to whom this survey was targeted.

The survey questionnaire was sent through various social media sites like the association's work groups within Lagos branch of Council of Engineering in Nigeria, Lagos branch of Engineering association groups in LinkedIn, Engineering and Manufacturing industry's WhatsApp work groups, emails of work colleagues, customers, friends and families with Engineering background. These engineers, who represent various engineering specialties and levels of expertise, were chosen all throughout the cities within Lagos state of Nigeria.

A brief summary of the survey, along with a link to view it online, were included with the questionnaire that was broadcasted to various organizations, associations and group of people as outlined above.

To assess how the survey will be accepted, and what the reactions of the respondents might be, a test phase survey test phase was drafted using the Monkey survey application. This lasted for 10 days with 10-targeted engineers responding to the survey as timely as possible and this gave much room to the design and application of the main survey questionnaire using the Google form survey application and targeting about 2,700 engineering professionals in various works and discipline.

The Scope and Nature of the Survey

This report presents the results of a questionnaire addressed to a sample of Registered and Non-registered Engineering members of the Lagos State branch of the Council for the Regulation of Engineering in Nigeria. Work WhatsApp member groups of Nigeria Society of Engineer, Engineering and manufacturing work groups and associations, customers, colleagues, friend and families of Engineering extracts, all of Lagos state branches and living within the Lagos state cities.

The survey ran for a period of 60 days (April 20 to June 18, 2023) for which about 267 Engineer respondents participated and their results obtained. This indicates about 10% representation of the 2,700-targeted individuals out of the data from Council for the regulation of Engineering in Nigeria for the Lagos State branch where the survey was conducted. The Participating groups and connections were intermittently sent reminders about 3 – 4 times within the period and with also a thank you note message to keep in view the need to complete the survey. The data results and analysis of this survey will provide up-to-date statistics and useful information to inform and guide employers, training personnel, professional institutions, regulatory agencies, government departments, and engineers themselves on what management skills and competence may be required at various stages of professional engineers' careers. The used questionnaire closely resembled the one the Engineering Council (UK) and its predecessors used in earlier surveys conducted in 2002. The complete list of skills and experience as profiled did, however, undergo some revisions to bring it into the global marketplace of the twenty-first century requirements and capabilities needed.

There are several stages that an engineers' career will go through as it progresses, and each level calls for a unique combination of education and experiences. When an engineer progresses through their career and shifts from technical expertise to project planning, coordination and leadership, there is an increase in the necessity for management skills. A typical introduction to management for an engineer is through this (Wentzheimer et al., 2004).

Evidence is available, nonetheless, to support the idea that even in entry-level positions, some managerial expertise is necessary.

The sampled questions posted in the survey are as listed below, the consent of the respondent in order to ensure data information security was requested as pre-requisite to partake in the survey.

- Q1: In which year the Engineer attain his/her qualification?
- Q2: How long the Engineer have been working?
- Q3 The major subject or engineering branch of the basic educational qualification
- Q4 Weather the Engineer holds any other Higher Degree outside BSc
- Q5 Technological vs. managerial content of the Engineer's job
- Q6 The level of responsibility the Engineer have in his/her job?
- Q7 The Engineer's level of knowledge of Soft Skills
- Q8 The most difficult or demanding aspect of job, if any?
- Q9. Present job title (Optional)
- Q10 Number and jobs of people directly responsible for
- Q11 Size of organisations and workplace.
- Q12: Age Range
- Q13: Sex
- Q14: Belonging to any Engineering Professional body
- Q15: Your view about the survey

A copy of the questionnaire is attached as Appendix A of this report.

With the survey methodology fully dealt with, we will be considering in the next chapter the details and analyzing the respondents results one after the other to make sense of the data received and how this reflects the skills and ability challenges of the professional engineers while transiting to leadership roles. The age groups, sex and year of work experience alongside their thoughts on other related questions will be carefully analyzed.

IV. Results and Analysis**The Survey**

There were 15 questions in the questionnaire. Closed-ended and somewhat open-ended questions were among the question types that are employed. Each question was created to either classify the engineers into comparable groups or to better understand how

each individual handled the shift into managerial roles. 267 (10%) of the 2,700 professionals targeted for the surveys replied and filled out the questionnaire.

Questionnaire Background Information

The background-gathering questions ranged from 1 to 6 and 13 to 14. These inquiries are inherently prepared and demographic in character. These queries and answers are summarized here. While others relate to the skills and responsibilities of the respondents.

For the purpose of data gathering protection, the survey required the respondents to give the consent before progressing to respond to the survey and this was achieved for all the 267 responses as shown below:

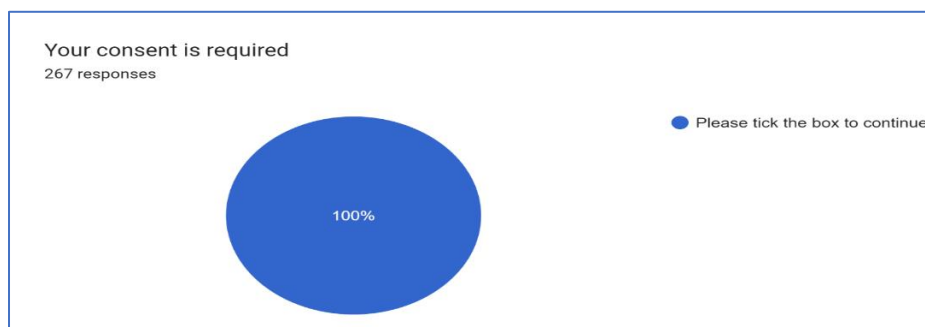


Figure 2. The Obtained consent of the respondents Source: Own results

Given that data repository is been governed under the Data protection acts, there was need to ensure that the respondent gave their consent as the pre-requisite to partake in the survey so as to protect the information gathered and eradicate any unforeseen challenges that might occur in future due to the information obtained.

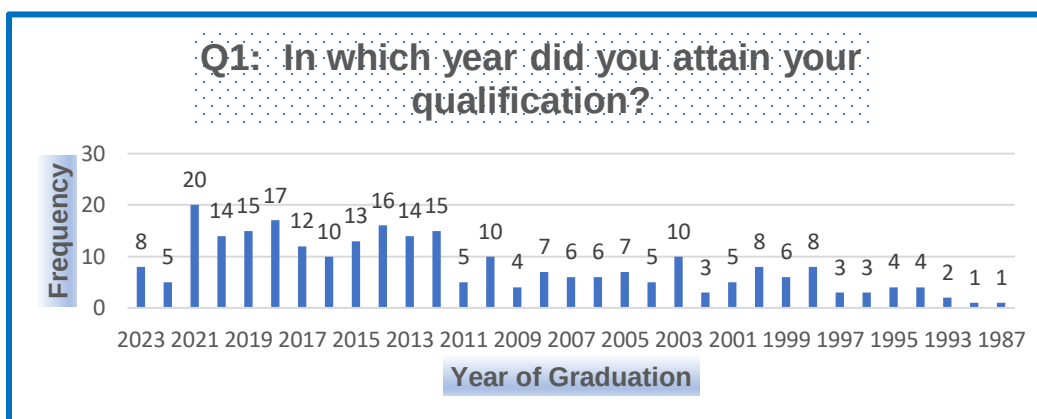


Figure 3. The year of attainment of first-degree qualification of the respondents (Source: Own results)

From the graph above, about 55% of the respondent graduated within the year 2012 – 2021, while the rest 40% were from the year 1987 to 2011, and a little 5% from 2022 to 2023. The 5% recorded from the One to Two years was expected given that most of them might not have been gainfully employed considering the jobs unavailability within the country at the moment, as the little one available from the various company will not consider fresh graduate due to scale of experiences needed to keep the work flow, productivity, revenue and profitability of the companies afloat.

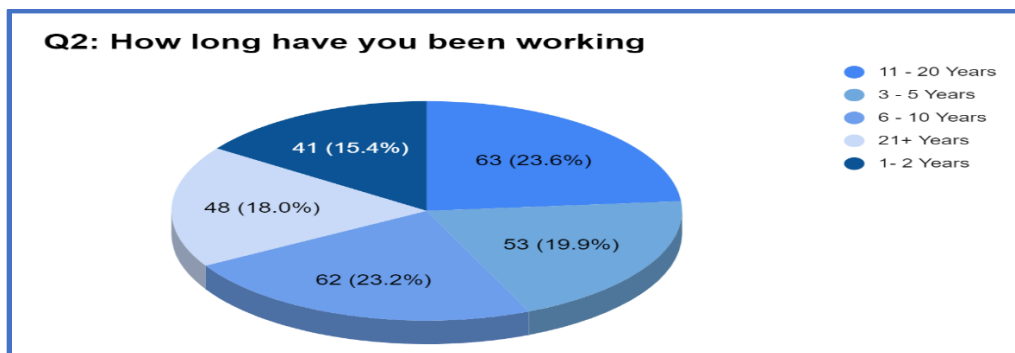


Figure 4. The working years of the respondents Source: Own results

From the data above, the Engineers whose working experience spans between Eleven (11) to Twenty (20) year's top the chart of the respondents, with a 23.6%, followed closely by those within the year of experience of Six (6) to Ten (10) years, while those of One to Two years of experience were the smallest respondent with a 15.4% coverage of the survey respondents.

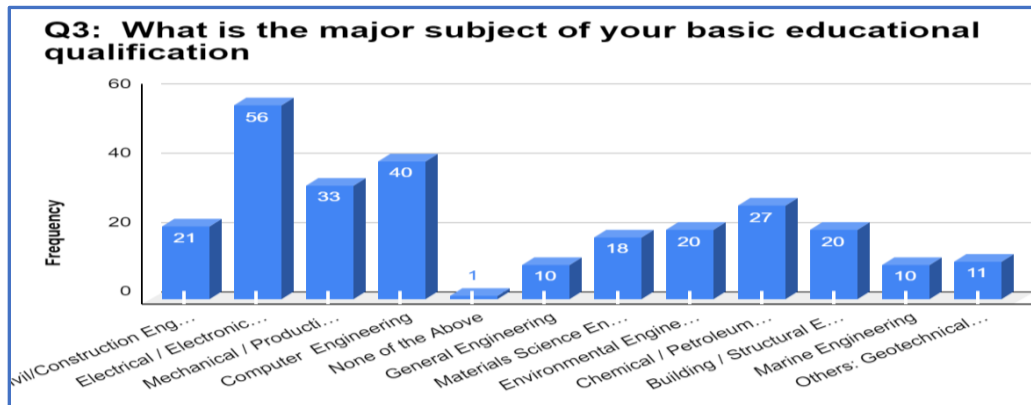


Figure 5. The Engineering sections or Specialization of the respondents Source: Own results

The data records above showing the different fields of study by the Respondent Engineers indicated that 21% representing 56 respondents studied Electrical and Electronics Engineering, this is obvious given that the researcher is from that field of studies and a great number of friends, colleagues and association members within that field where personally reached out to be part of the survey. Also respondents from Computer Engineering which is somewhat related to Electrical Engineering followed closely with a 15% representing 40 respondents and the factors is also as detailed above for the Electricals, since both fields (Electrical/Electronics and Computer Engineering personnels) works closely with each other in the fields of Telecommunications and Information Technology where the researcher had worked before or is working currently.

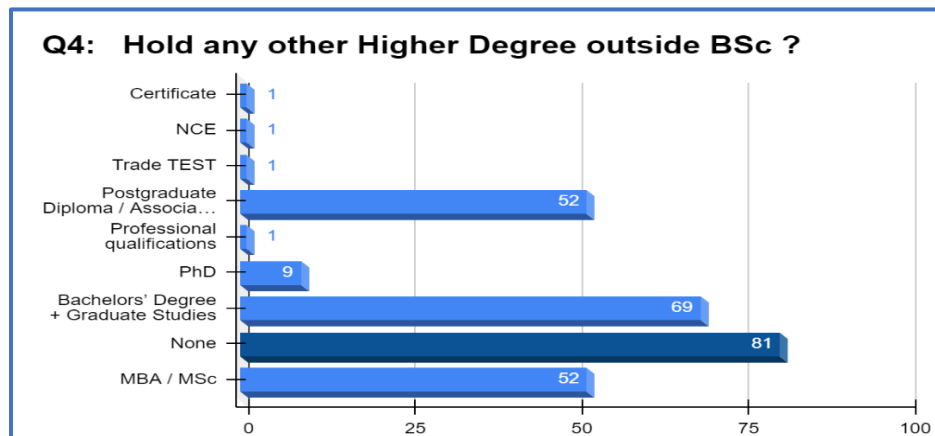


Figure 6. The additional Post qualification after first degree of the respondents Source: Own results

According to the survey's findings, 68.2% of respondents went on to earn further or postgraduate engineering certifications after earning their initial engineering degrees, while about 30% could not advance their educational knowledge.

Top of the chart from these are Masters, Graduate Studies and Post Graduate Diplomas implying the need for higher education and better understanding in their various work space.

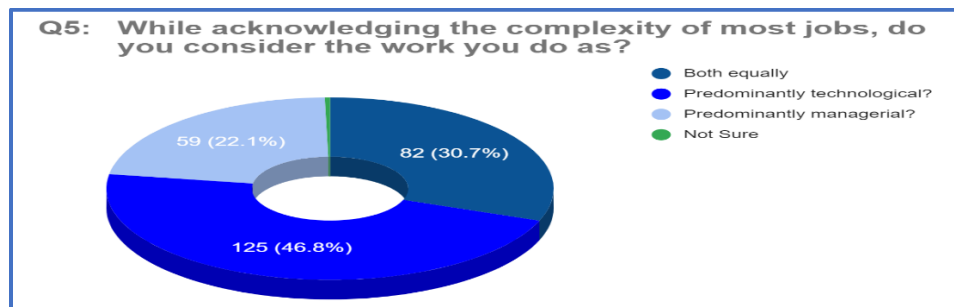


Figure 7. The work nature of the respondents

Source: Own results

From the graphic illustration above, out of the 267 respondents, a 46.8% representing about 125 Engineers which is almost half are working within the technological space. 30.7% indicated they combine in their line of work both managerial and technological skills or work nature while 22.1% are conducting exclusively managerial duties.

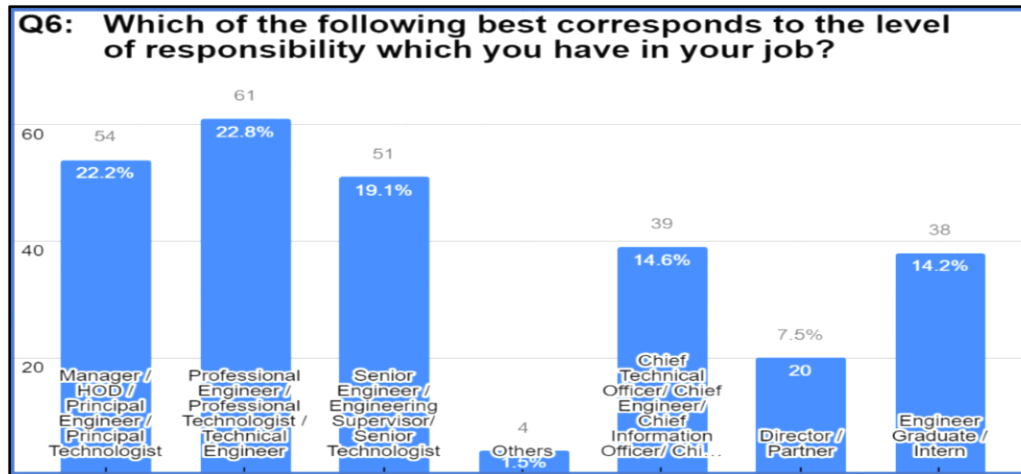


Figure 8. The Engineer respondents' level of Responsibility

Source: Own results

The majority of survey participants are employed by organizations as Managers/HODs (22.2%), Senior Engineers (19.1%), and Chief Technical Officers (14.6%). This shows Engineers are really taking up managerial and leadership roles as expected in this global competitive environment. It is also noteworthy that over 7.5% of respondents run or own businesses as directors or partners, compared to the overall figure of approximately 37% who hold lower-cadet positions such as professional engineers or recent graduates.

When compares with the 2002 UK survey which showed a 67% respondent from Manager/HOD upwards as respondents, this survey data above indicated that from the Manager's level to the Directors respondents were at an average of 44%, resulting to a sharp reversal of what was obtained in the previous surveys but more of even distribution by levels of responsibilities of the respondents that participated in the survey.

Q7 Knowledge of Soft Skills

The answers to the questions below are recorded in the table & graph below:

Questions	Agree	Disagree	Not Sure
Ever heard about soft skills before?	216	50	1
Engineers should be more than technical experts. Do you agree	144	120	3
Do you think that engineers are considered to be lacking in these skills?	106	133	28
Do you think employers look for more than technical knowledge when they employ or promote engineering graduates?	141	108	18
Would soft skills improve your employment and promotion opportunities?	169	83	15
Do you think lack or insufficiency of these skills can hinder such chances?	148	91	28
Should soft skills be included in your professional training?	208	55	4
Should Soft skills should be taught at university from undergraduate level	189	65	13

Table 1. The Engineer respondents' table on soft skills

Source: Own results

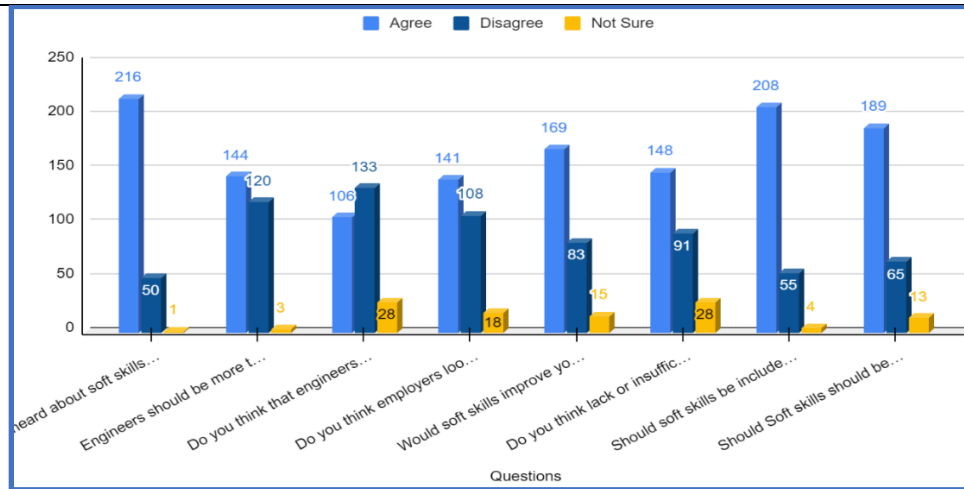


Figure 9. The Engineer respondents' graph on soft skills

Source: Own results

From the data obtained as shown above both on the table and graph, its obvious while some Engineers affirmed in the opposite concerning soft skills, that most of the respondent knows and believe that soft skills experiences are the way to go. More explanation will be expounded in the analysis of the results obtained later in this document.

Some Engineers whose thoughts and opinions on the soft skills are neither here nor there (not sure) are quite infinitesimal and won't make any tangible view to be discussed.

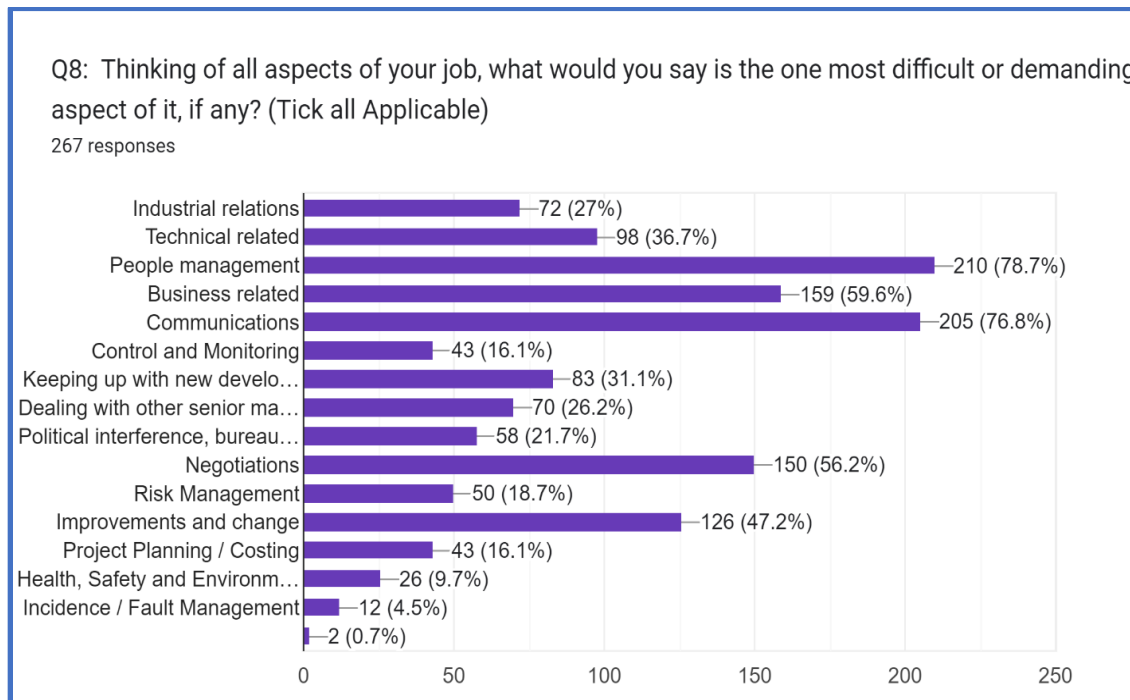


Figure 10: The Engineer most difficult aspect of job

Source: Own result

Considering the figure above, we can see those non-technical jobs and skills, such as people management, communication, business related, negotiation and improvements and change top the chart of the graph on some of the most demanding aspect of the day-to-day work of the Engineers, and this obviously cut across all discipline and possibly age.

There seems to be some level of resembles of the data obtained in this 2023 survey compares to that of the UK 2002 in these areas of most demanding or difficult aspect of their jobs. The 2002 UK survey indicated that the top three most difficult aspect of the job by the respondents of 2002 were Control (26%), People management (15%), and Business (14%). For the 2023 survey, the data identified the three top most as shown above as People Management, Communication and Business.

However, there seems to be a sharp reversal position in difficulty roles between communication and control skills in both 2023 and 2002 surveys respectively.

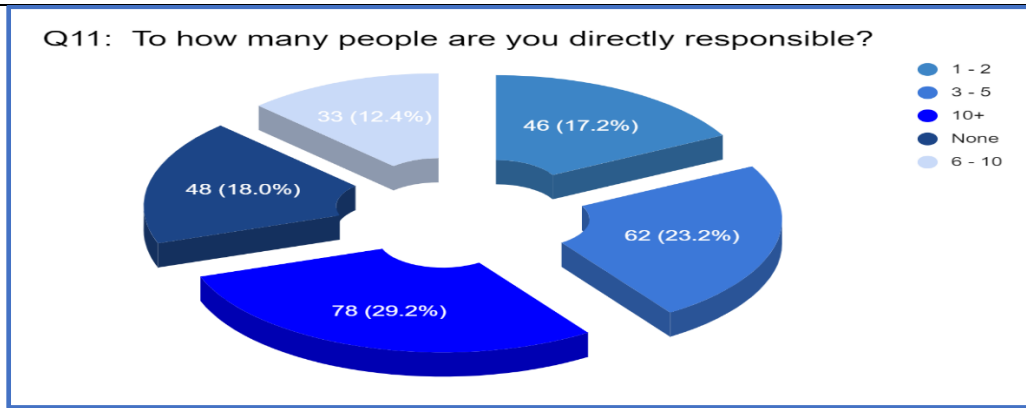


Figure 11: The Engineer direct responsibility on colleagues

Source: Own results

Reviewing the information obtained on figure 11 above, a lot of supervisions and leadership roles are carried out by Engineers who responded to the survey. About 29% were responsible for staff from 10 and above, 23% were responsible for 3 to 5 staff, 17% managed 1 or 2 people while about 18% were not responsible for anyone. They obviously were under someone or are standalone staff probably working as specialist.

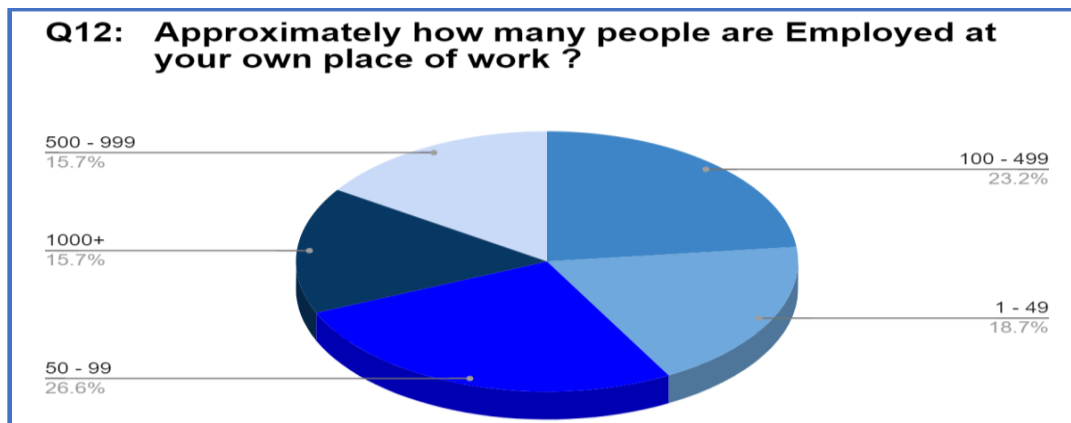


Figure 12: The Engineer respondents place of work size Source: Own results

For the Engineers that responded to the survey, about 50% are working in companies with staff range from two ranges of 50 to 499. These companies surely have a good staff strength and will also have well segmented units or departments which will give way to different staff skills, intra-office relationships and work integrations in-order to seamlessly handshake across all units, picking up divers' skills and knowledge as they work together unlike what we observed from the UK surveys of 2002 and 1979.

This system also expands into organizational rich culture of people from different sections or language.

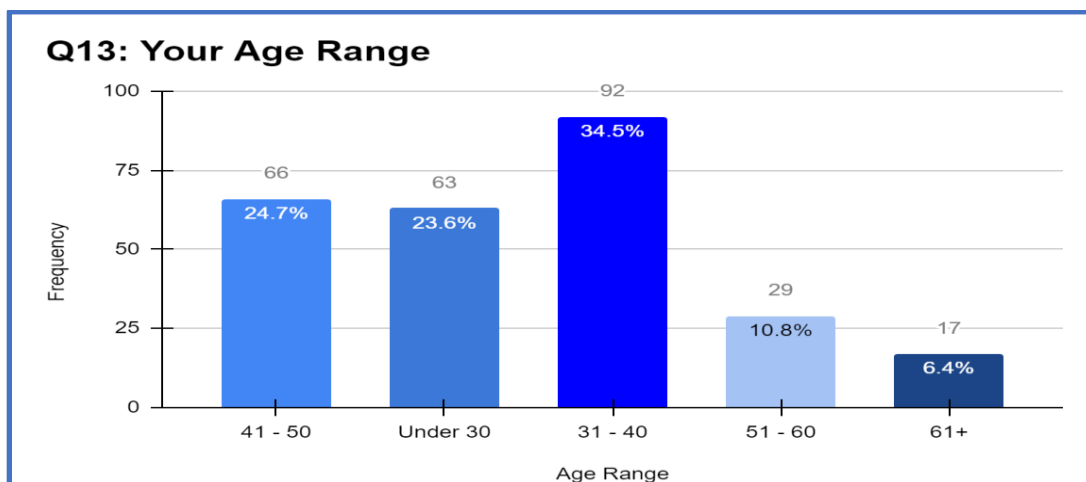


Figure 13: The age range of Engineer respondents

Source: Own results

Observation from the graph above indicates that Engineers in their active work age responded to the survey much more than older ones. It showed that those within 31 to 40 years of age covered a little above one third total respondent with a percentage of 35%, closely followed by those within 41 to 50 years of age with a 28% response, while those under the age of 30 years took the third place of those who responded to the survey.

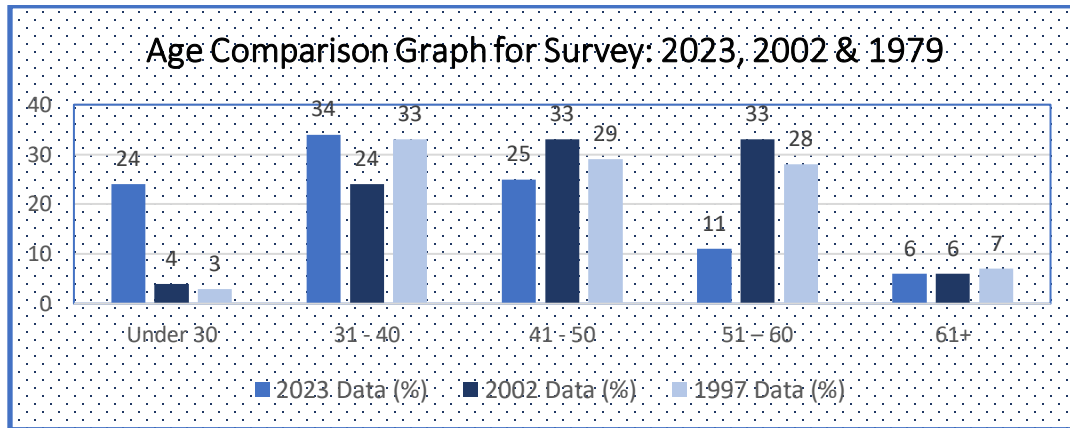


Figure 14: The Engineer respondents' Age table on comparing other surveys Source: Own results

There is a close resemblance with the data obtained from the 2023 survey when compared with both the UK 2002 and 1979 surveys, though with a slight exception in the 2023 survey for those under 30 years of age (a sharp increase on the number for 2023) and 51-60 years (an obvious drop on the number for 2023) respectively of the respondents as shown

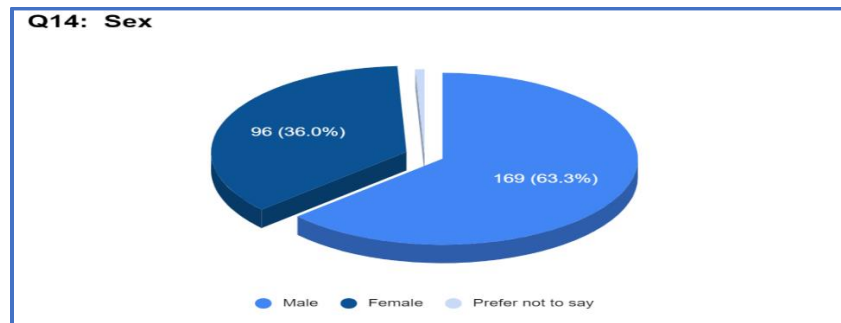


Figure 15: The Sex analysis graph of Engineer respondents Source: Own results

Based on the graph figure 15 above, about 63% of the respondents are male Engineers while the female Engineers recorded about 36% that responded to the survey and all from different departments of Engineering. However, there is a 1% of those who prefer not to say their sex as either male or female representing about 2 people.

The lower range of the female respondent were expected given that the Engineering career or discipline are mainly dominated by the male folks and this is in agreement with the survey data obtained from the 1979 and 2002 UK surveys.

There has nonetheless been an increase in the number of females pursuing their career in the STEM and or with more focus on the engineering degrees recently.

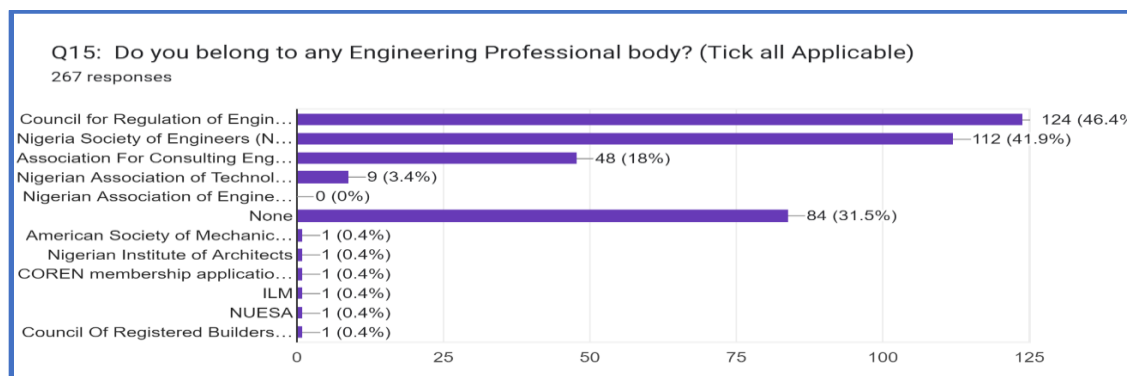


Figure 16: The Engineering Professional Associations Source: Own results

Question 15 was included in the survey to get a feel of the professional association that the respondents belong to, and based on the data as shown on figure 16 above, there are a lot members of the council of regulation of Engineering in Nigeria as well as belonging to the Nigeria society of Engineers of those who participated in the survey. However, we recorded a 31.5% of the respondent who did not belong to any professional bodies whatsoever.

Having listed out the questionnaire questions and their various response rate, we will be doing some vital analysis and in-depth review of the responses as recorded in the next section.

The Result Analysis

Analysis on Data Varieties of the Respondents

<Analysis of Age and Role>						
		Q13: Your Age Range				
Q5: While acknowledging..	Null	Under 30	31 - 40	41 - 50	51 - 60	61+
Null	7					
Both equally		10	30	27	7	8
Not Sure		1				
Predominantly manageria..		3	9	19	19	9
Predominantly technologi..		49	53	20	3	

Table 2. The Engineer respondents' table on Age and Role Source: Own results

The table 2 above detailed the age range of the respondents in relations to the nature of the job they do. About 35% of the respondent who were of the 31-40 years age range has the highest number that participated in the survey, and this is followed up by 41-50 age range with 24% and Under 30 of age with 23% while from 51 age and above represent 13% respondents and who invariably deals only with managerial work nature.

On the nature of jobs, about 47% confirmed their work are predominately technological in nature, with 22% confirming theirs as predominately Managerial and 31% as having the jobs interwoven all in managerial and technological jobs.

Of interesting analysis is the fact that from age 40 and below representing 39% of respondents were primarily focuses on technological work nature and the managerial or leadership skills and abilities progresses as the Engineering personnel aged.

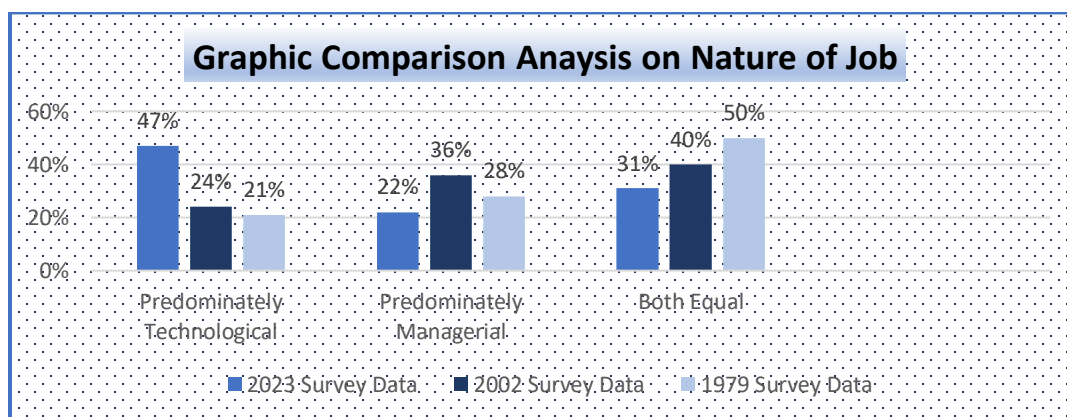


Figure 17: Work Nature comparison for surveys of 2023, 2002 and 1979 Source: Own result

In comparing this 2023 survey data with that of the UK 2002 and 1979 engineers survey which outputted a 24% and 21% respectively for those whose primary work were technological, and others of 'managerial' / "both equal" roles were 36%/ 40% and 28%/ 50% respectively of the respondents.

The UK 1979 and 2002 surveys manifested a high level of Managerial personnels, and very little number for those on technologically job roles, to that of this 2023 survey. This could mean that while the 1979 and 2002 surveys mainly targeted the high caliber of respondent engineers who probably did not cascade or inform their juniors of this survey, reason why it was highly skewed in favour of the managerial and senior engineers with those that combine the managerial and technological work together.

Another analysis could also mean that the survey of 1979 and 2002 showed that many engineers of that time were hands on and open to lots of managerial positions and were probably doing well in their various fields into leadership roles.

<Analysis of Sex and Age of Respodents>			
Q14: Sex			
Q13: Your Age Range	Female	Male	Prefer not to say
31 - 40	35	57	
41 - 50	25	41	
51 - 60	9	20	
61+	6	11	
Under 30	21	40	2

Table 3. The Respondents' analysis table on Age and Sex Source: Own results

Of the total 267 respondents that participated in the survey, 96 of them representing 36% were Female, while the rest 64% were Male Engineers. Whilst this is expected given that the male folks dominate the Engineering profession, it should be noted that recently, there have been a steady increase in the number of females pursuing their carriers in the Engineering side, which can be collaborated by the Under 30 and 31 to 40 Age range.

<Analysis table of Male /Female Respondents & Roles>			
Q14: Sex			
	Female	Male	Prefer not to say
Q5: While acknowledging the complexity of most jo..	Count of Form Responses	Count of Form Responses	Count of Form Responses
Predominantly technologi..	1	1	1
Predominantly manageria..	39	86	
Both equally	25	34	
Not Sure	32	49	1
			1

Table 4. The Engineer respondents' table on Roles and Sex Source: Own results

Analyzing the table 4 above, it will be noted that considering the number of females that participate, they have a higher percentage of those having predominately managerial (26%) and also of those combining both managerial and technonological (33%) when compare to the male folks (20% and 29% respectively). The reason for this is not quite known as this time but will make a good case for further studies.

<Higher Degree and Sex>			
Q14: Sex			
Q4: Hold any other Higher Degree outside BSc ?	Female	Male	Prefer not to say
PhD	2	7	
MBA / MSc	15	37	
Postgraduate Diploma / A..	19	32	1
Bachelors' Degree + Grad..	31	37	1
Professional qualifications		1	
Certificate		1	
None	29	52	
NCE		1	
Trade TEST		1	

Table 5. The Engineer respondents' table on Sex and possession of Higher Degree Source: Own results

The table 5 above indicated that there was an almost equal desire from both the male and female engineer respondents to further their education and acquire a higher degree. This is a good desire and pursuit as further leaning will position them to be able to work well, make better decision and be promoted as they progress in their career and further acquire other related skills not inherent in their first-degree programs.

<Analysis of Sex and Level of Responsibility>								
		Q6: Which of the following best corresponds to the level of responsibility ..						
Q14: Sex	Q4: Hold any other Higher Degree out..	Director / Partner	Chief Technica..	Manager / HOD / Pri..	Senior Engineer..	Professio nal Engin..	Engineer Graduat..	Others
Female	Bachelors' Degree ..	4	5	12	6	3	1	
	MBA / MSc	1	9	5				
	None			4	4	7	14	
	PhD	1	1					
	Postgraduate Dipl..	2		2	4	11		
Male	Bachelors' Degree ..	2	4	11	14	5	1	
	Certificate				1			
	MBA / MSc	5	14	9	6	2	1	
	NCE							1
	None	1	1	5	5	21	19	
	PhD	3	3					1
	Postgraduate Dipl..	1	2	5	10	12	2	
	Professional qualif..							1
	Trade TEST				1			
	Prefer not to say							1
	Postgraduate Dipl..			1				

Table 6. The Engineer respondents' table on Sex, Higher Degree and Responsibility Source: Own results

The Table 6 above did a deep dive into how the respondents progressed while acquiring a higher education after their first degree and level of responsibilities they reached in their various roles. The table indicates that there is a correlation between obtaining a higher degree and progressing in their careers. The percentage of respondent engineers from Senior Engineers and above that are with a higher degree (with 40%) are more than those who just have only their BSc or first degree (21%) and within the same level of responsibilities of Senior Engineers and above.

This also collaborated the notion that higher education tends to provide some skills, which are needed, as higher levels of responsibilities are demanded. The likelihood of acquiring more soft-skills from the acquisition of higher degree(s) can also be the reason for the increase of those with the additional education into managerial and senior positions.

<Higer Qualification compares with Work Age>						
		Q2: How long have you been working				
Q13: Your A..	Q4: Hold any other Highe..	1- 2 Years	3- 5 Years	6- 10 Years	11- 20 Years	21+ Years
Under 30	Bachelors' Degree + Grad..	2	3			
	MBA / MSc		1			
	NCE	1				
	None	29	15	1		
	Postgraduate Diploma / A..	4	7			
31 - 40	Bachelors' Degree + Grad..		6	12	9	
	Certificate			1		
	MBA / MSc			7	2	
	None	4	9	11	1	
	PhD				1	
	Postgraduate Diploma / A..		12	15	1	
	Trade TEST	1				
41 - 50	Bachelors' Degree + Grad..			8	15	3
	MBA / MSc				18	2
	None			3	5	1
	PhD				1	2
	Postgraduate Diploma / A..			4	4	
51 - 60	Bachelors' Degree + Grad..				1	6
	MBA / MSc				4	10
	PhD					2
	Postgraduate Diploma / A..				1	4
	Professional qualifications					1
61+	Bachelors' Degree + Grad..					4
	MBA / MSc					8
	None					2
	PhD					3

Table 7. The Engineer respondents' table on Higher Degree and Work Age Source: Own results

A review of the table 7 reveals that as the engineers work age increases, the more they seek for higher degrees. This can be observed on the table above, that from the age range of 41 years and above, and who has spent up to 6 year and above, the number of respondents that acquired a degree after their BSc rose sharply up high from those who has spent over 10 years of age with different levels of certification, Master's degree and even doctoral education.

<Discipline and Age>					
Q3: What is the major sub..	Q13: Your Age Range				
	Under 30	31 - 40	41 - 50	51 - 60	61+
Building / Structural Engineering	4	10	3	3	
Chemical / Petroleum Engineering	3	8	9	5	2
Civil/Construction Engineering	6	4	8	1	2
Computer Engineering	13	18	6	2	1
Electrical / Electronic Engineering	8	24	10	8	6
Environmental Engineering	6	7	5	2	
General Engineering	1	4	4		1
Marine Engineering	5	2	2		1
Materials Science Engineering	4	4	8	2	
Mechanical / Production Engineering	7	8	9	6	3
Others: Geotechnical Engineering, Metallurgy, ..	5	3	2		1
None of the Above	1				

Table 8. The Engineer respondents' table on Discipline and Work Age Source: Own results

The Table 8 above show a cross-section of the various discipline from the respondent and how spread within the engineering departments that attended to the survey. While Electrical engineering and computer engineering total a higher response, the survey spread covering almost all areas of the engineering discipline and age range is commendable to ensure a varied opinion was achieved.

<Engineering Discipline and Responsibility>							
Q3: What is the major subject of your basic educ..	Q6: Which of the following best corresponds to the level of responsibility which ..						
	Director/ Partner	Chief Technical ..	Manager/ HOD/ Pri..	Senior Engineer/..	Profession al Engine..	Engineer Graduate ..	Others
Building / Structural Engineering	1	2	4	5	5	3	
Chemical / Petroleum Engineering	5	4	7	4	6	1	
Civil/Construction Engineering		7	3	6	1	4	
Computer Engineering		5	8	5	11	10	1
Electrical / Electronic Engineering	3	9	14	13	12	2	3
Environmental Engineering	1	2	2	4	7	4	
General Engineering	1		3	3	2	1	
Marine Engineering	1		1	1	5	2	
Materials Science Engineering	2	1	5	5	3	2	
Mechanical / Production Engineering	5	8	5	4	6	5	
None of the Above					1		
Others: Geotechnical Engineering, Metallurgy, ..	1	1	2	1	2	4	

Table 9. The Engineer respondents' table on Discipline and Responsibility Source: Own results

As observed on table 9 about the spread of the respondent across the engineering discipline and the age range for the survey, the same cover and spread was also noticed from the respondent across the various discipline and their levels of responsibilities in their various works of life. All the fields from the highest decision-making position as Directors or business partners down to the fresh graduates and or graduate interns was fully represented in the survey. This helps to ensure a wide spread of opinions, thoughts and solid inference with the survey. The survey would have been lacking in some measures if these spread from age, responsibilities and department was not achieved.

Data Compare on Sex and Age of 2023 Survey to Others Surveys

When compared to data from respondents of this 2023 survey and the Engineering Council (UK) Survey of 2002, the distributions of respondents by age and sex displayed in Tables 6 and 9 match to a good level. The survey from 2023 demonstrates that the respondents are clearly younger and more evenly distributed across the engineering discipline and level of responsibilities than the survey from 2002 and 1997, whose respondents were also older and primarily from one engineering department of Electrical Engineering. From our 2023 data, this is an indication that there's greater awareness and reach to the respondents and that there's been some form of desire for the engineering personnel to change the narratives.

In the next session, we will be reviewing and analyzing the engineer's thought about soft-skills and thereafter the most work demanding skills they encounter as challenging in the course of their works.

Analysis on Engineer Respondents thought on Soft-skills

It's important to mention that these soft-skills questions as reviewed below, were not part of the questions asked in the UK 1979 and 2002 surveys. As such will not be considered in the comparison of the data, however it will be compared to an extract survey of Engineering professionals' perspectives on the role of soft skills in the practice, conducted in South Africa in 2021.

In order to gather information about the importance of soft skills in the workplace in South Africa, 50 active engineering professionals from a range of disciplines were invited to complete a questionnaire.

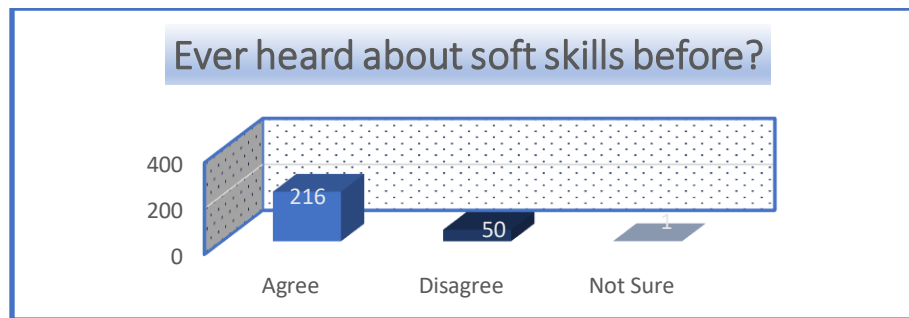


Figure 18: The Engineer respondents' table on Knowledge of Soft-skills Source: Own results

From the figure 18 above, the graph indicated that about 216 engineer respondents were aware and have heard about Soft-skills before now. This represents a huge 81% of the respondents. This particular question was not part of the direct questions asked in the South Africa 2021 questionnaire, but as a follow up comment by defining what soft-skills actually mean. However, this was asked here to have a feel of the engineer's knowledge about the subject matter (Soft-Skills).

<On Softskills: Employers Check while Recruiting/Promoting>					
		Q7: Knowledge of Soft Skills (Do you think employers look for mor..			
Q14: Sex	Q6: Which of the followin..	Agree		Disagree	
					Not sure
Female	Director / Partner	2		6	
	Chief Technical Officer/ C..	9		5	1
	Manager / HOD / Principal..	11		11	1
	Senior Engineer / Enginee..	6		7	1
	Professional Engineer / Pr..	9		9	3
	Engineer Graduate / Intern	3		10	2
Male	Director / Partner	10		2	
	Chief Technical Officer/ C..	10		14	
	Manager / HOD / Principal..	18		11	1
	Senior Engineer / Enginee..	27		7	3
	Professional Engineer / Pr..	21		13	6
	Engineer Graduate / Intern	12		11	
Prefer not to say	Others	2		1	
	Manager / HOD / Principal..			1	
	Others	1			

Table 10: Weather Soft-skills are considered by Employers during recruitment Source: Own results

On reviewing the table 10 above, it will be noted that the question on whether employers consider having soft-skills when either recruiting or promoting an engineering personnel, the responses returned with a 53% affirmative, while about 40% disagrees and about 6.7% are not sure on if the employer reconsiders soft-skills.

<On Softskills: Lack of Soft-skills hinders Employment/Promotion >				
		Q7: Knowledge of Soft Skills (Do you think lack or insufficiency of ..		
Q14: Sex	Q6: Which of the followin..	Agree	Disagree	Not sure
Female	Director / Partner	5	3	
	Chief Technical Officer/ C..	9	5	1
	Manager / HOD / Principal..	12	9	2
	Senior Engineer / Enginee..	8	5	1
	Professional Engineer / Pr..	9	7	5
	Engineer Graduate / Intern	3	11	1
Male	Director / Partner	8	3	1
	Chief Technical Officer/ C..	14	9	1
	Manager / HOD / Principal..	20	9	1
	Senior Engineer / Enginee..	25	5	7
	Professional Engineer / Pr..	24	11	5
	Engineer Graduate / Intern	7	13	3
	Others	2	1	
Prefer not to say	Manager / HOD / Principal..	1		
	Others	1		

Table 11. Weather lack of Soft-skills can hinder recruitment or Promotion Source: Own results

Reviewing the table 11 above, 55% respondents of the engineers that participated on the survey believed that lack of soft-skills from the Engineers has the capacity to hinder such engineers on being employed and or promoted to another higher level as can be seen on table 11 above, however about 34% of the respondent believes otherwise.

Interestingly, both the male and female engineers share this same school of thought on acquisition of soft-skills and its benefits in recruitment and or promotional opportunity.

<Softskills will Improve Employment Opportunity?>					
		Q7: Knowledge of Soft Skills (Would soft skills improve your emplo..			
Q14: Sex	Q6: Which of the followin..	Null	Agree	Disagree	Not sure
Null	Null	7			
Female	Chief Technical Officer/ C..		8	6	1
	Director / Partner		5	3	
	Engineer Graduate / Intern		5	10	
	Manager / HOD / Principal..		14	9	
	Professional Engineer / Pr..		12	7	2
	Senior Engineer / Enginee..		11	3	
Male	Chief Technical Officer/ C..		12	11	1
	Director / Partner		9	2	1
	Engineer Graduate / Intern		10	10	3
	Manager / HOD / Principal..		19	9	2
	Others		2	1	
	Professional Engineer / Pr..		32	6	2
	Senior Engineer / Enginee..		28	6	3
Prefer not to say	Manager / HOD / Principal..		1		
	Others		1		

Table 12. Weather Soft-skills can improve Employment opportunity. Source: Own results

In table 12 above reveals from the data shown that over 63% of the engineer's respondent agrees that availability of soft-skills enhances and improves employment opportunity, while 31% do not share such believes and as such disagrees on the employment opportunity of an engineer due to availability of soft-skills in addition to their technical abilities.

This broad consensus reveals how important these skills and abilities are thought to be in the workplace.

<Should Softskills be Included in Professional Trainings>								
		Q6: Which of the following best corresponds to the level of responsibility whi..						
Q7: Knowledge ..	Q14: Sex	Chief Technical..	Director/ Partner	Engineer Graduate..	Manager/ HOD/Pri..	Others	Profession al Engine..	Senior Engineer ..
Agree	Female	9	6	11	20		19	10
	Male	20	9	13	21	2	35	31
	Prefer not to say				1	1		
Disagree	Female	5	2	3	3		2	4
	Male	3	3	9	9	1	5	6
Not sure	Female	1		1				
	Male	1		1				

Table 13. Should Soft-skills be included in Engineers' Professional trainings Source: Own results

A huge 208 number of Engineers representing about 78% of the respondents of the total 267 engineering consent to having soft-skills be included in their professional trainings as indicated on the table 13 above. These cut across both male and female as well as engineers in all levels of job responsibilities.

Because not all businesses have the capacity to spend in soft skills training for their employees, training institutions as a matter of urgency must incorporate soft skills into their curricula so that their graduates have a competitive advantage and be rightly positioned to face work challenges appropriately.

<Softskills should be taught in Undergraduate University ?>				
		Q7: Knowledge of Soft Skills (Should Soft skills be taught at unive..		
Q14: Sex	Q4: Hold any other Highe..	Agree	Disagree	Not sure
Female	Bachelors' Degree + Grad..	26	3	2
	MBA / MSc	7	8	
	None	15	11	3
	PhD	2		
	Postgraduate Diploma / A..	11	7	1
Male	Bachelors' Degree + Grad..	27	8	2
	Certificate	1		
	MBA / MSc	32	4	1
	NCE	1		
	None	36	15	1
	PhD	3	4	
	Postgraduate Diploma / A..	25	4	3
	Professional qualifications	1		
	Trade TEST		1	
Prefer not to say	Bachelors' Degree + Grad..	1		
	Postgraduate Diploma / A..	1		

Table 14. Should Soft-skills be taught in Engineers' Undergraduate University Source: Own results

In agreement with the responses on whether soft-skills should be included in engineer's professional training, the table 14 above also indicated a 70% respondent agreement that soft-skills studies or curriculum should be included in the engineer's undergraduate university studies.

It should also be noted that respondent engineers of divers' levels of education shares this same thought and agreement.

This supports the claim that engineers are currently faced with obstacles that are significantly different from those faced by their forebears and that these challenges will continue to change in the future. In order to prepare our graduates for the problems of the twenty-first century, "Significant changes in engineering education will be required" (Rugarcia et al., 2000) .

Analysis Comparison on responses with that of South Africa 2021 Survey

	Agree (%)			Disagree (%)			Not Sure (%)	
	SA / 2021	NIG / 2023		SA / 2021	NIG / 2023		SA / 2021	NIG / 2023
Ever heard about soft skills before?	-	81		-	19		-	0
Engineers should be more than technical experts. Do you agree	96	54		2	45		2	1
Do you think that engineers are considered to be lacking in these skills?	70	40		16	50		14	10
Do you think employers look for more than technical knowledge when they employ or promote engineering graduates?	82	53		12	40		6	7
Would soft skills improve your employment and promotion opportunities?	100	63		0	31		0	6
Do you think lack or insufficiency of these skills can hinder such chances?	86	55		6	34		8	11
Should soft skills be included in your professional training?	94	78		4	21		2	1
Should Soft skills should be taught at university from undergraduate level	86	71		8	24		0	5

Table 15. Soft-skills Comparison between Surveys SA 2021 and Nigeria 2023 Source: Own results

This is to reemphasize that the south Africa 2021 survey respondents were 50 Engineers, when compare to the respondent of this 2023 survey with 267 engineers' respondents.

From the table 15 above, it can be inferred that, there is a strong relationship between the responses obtained from the South Africa 2021 survey, about Engineers feelings towards soft-skills compares to this 2023 survey in Lagos Nigeria. There is an exception though, on one of the questions to which the engineer's response on 2023 survey differ a bit where "Engineers are considered to be lacking in these skills. This 2023 survey do not concede strongly in the affirmative that engineers are lacking with about 50% disagreeing while 10% are not sure, unlike what was obtained from the south Africa survey that had a huge 70% affirmative.

According to the responses, the majority of participants concur that having technical knowledge alone is not enough to succeed in the engineering field and in transiting to managerial or leadership role. For employment and promotion chances, soft skills are essential and play a big part in their job roles. They ought to be a part of engineers' professional training beginning in the undergraduate years.

This serves as another evidence that engineers must successfully combine knowledge from various fields in the humanities, social sciences, and arts in order to come up with innovative and appropriate solutions for today's problems.

The next section 4.3, reviews and analyzes the Engineer's response and how they relate to those different work skills that are most demanding and or difficult in the line of their work duty.

Respondents Results on Most Difficult Work-Skills and Requirement

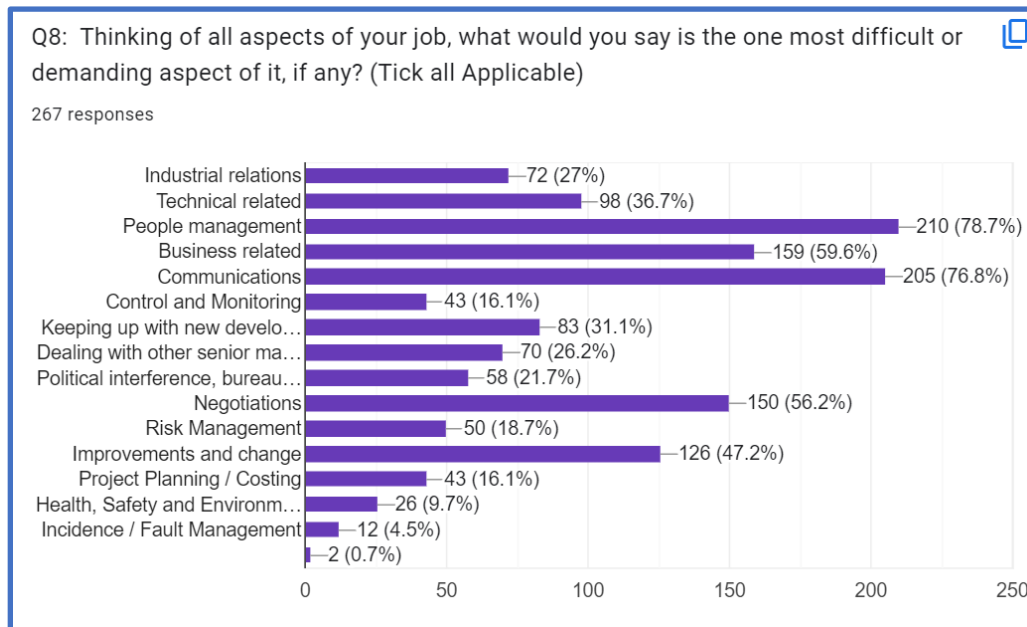


Figure 19: Respondent's view on most difficult or demanding aspect of their job

Source: Own results

A cross-section of 15 work skills were surveyed to understand how demanding the respondents' engineers cutting across different levels of responsibility views and feels about such work skills in the line of their duty as they progress in their career.

From the figure 19 as detailed above, it was observed that these five (5) works skills top the chart graph as the most difficult and or demanding of their works in the descending order: People Management (78.8%), Communication (76.8%), Business related (59.6%), Negotiations (56.2%) and Improvement/Changes (47.2%).

It should be noted surprisingly, that these top five (5) listed work skills are what leaders or managers deal with in their day-to-day line of work duty.

We will be considering these skills one after the order in the next sub-section but it should be noted that these skills are all non-technical in nature and the engineers feels somewhat awkward relating to these skills, the reason they consider them very demanding, the reason this research work was put in place.

The technical aspect of their work skills came a distance 6th position with about 37% representing a paltry 98 out of 267 of the respondents considering it part of the demanding work skills.

Analysis on Engineer Respondents most difficult Work-Skills

Based on the response from the survey as explained in the last section above, we observed these top 5 work skills were considered most difficult and demanding by the Engineers in the line of their work duty. The work skills identified were: People Management (78.8%), Communication (76.8%), (Business related (59.6%), Negotiations (56.2%) and Improvement/Changes (47.2%).

Interestingly, the UK survey of 2002 identified strongly with about 2 of these top five work skills mentioned above as People Management and Business related, and though Managerial control was the topmost in the UK 2002 survey, however this particular skill was among the least identified by the respondents this survey as seen on the graph above.

Let's review these skills a bit deeper starting from the most demanding and downward as well as to put a better explanation and understanding on what this work skills are.

People Management Skill

The people management work skills top the chart of most difficult or demanding with a record of over 78% of the respondents. Business executives in general are aware of the value of their workforce. The fact that their people management skills and abilities can have a much greater influence than their employees' inherent aptitude is something that many fail to realize.

Actually, employing effective people management techniques is just as crucial as having good employees, if not more so.

But what really is People Management?

On the surface, people management appears to be about overseeing employees in the workplace, making sure they are taken care of and have everything they need to complete their tasks. However, It's fundamentally about paying attention to and taking care of employees. Taking care of their wellbeing, kindly assisting them in overcoming obstacles, or motivating them to perform their best work and strive to achieve their professional and personal development objectives are all examples of how to do this.

It is a mindset to monitor people's mental health. To successfully accomplish goals and objectives at work, effective people management is crucial. (Dutta & Chaudhry, 2021)

Poor people management skills could result in the following outcomes:

Ill-equipped teams and employees and inability to handle challenges; Workflow errors result from poor communication; Unresolved or ongoing employee conflict; High employee turnover rates; A lack of professional development among employees; A lack of knowledge and idea sharing within the organization, according to *Melissa Malec, 2022 -www.learnerbly.com/*.

Communication Skill

The second most demanding work skills following closely the people management with a 76.2% respondents view is Communication work skill. And like the people management skill, Communication skills is also a non-technical skill and highly imperative in managerial or leadership roles and positions.

What is Communication skill?

The skills necessary for achieving objectives involving social talents, interpersonal abilities, and personal attributes are Communication skills. Because they are similar to feelings or visions that allow people to "read" other people, these skills and or abilities are known as "soft" skills. These skills are necessary in the workplace because nearly every profession entails involvement with or interaction with others in one form or another (Gioiosa & Kinkela, 2019).

Communication refers to any meaningful and productive interaction between people. It frequently involves a few basic steps, such as establishing the message's purpose, writing it, encoding it, sending it, decoding it, and then having the recipient interpret it (Al-alawneh et al., 2019).

Both verbal and nonverbal communication are vital for successful communication; one form of communication cannot exist without the other. Presentations, meetings, job interviews, and emails are just a few examples of the forms that are further divided into spoken-vocal and non-vocal gestures. Frequently, meanings are conveyed without the use of words at all by means of paralinguistic features including emphasis, intonation, volume, passion, and tempo. (Al-alawneh et al., 2019)

By focusing on the right perception of a person's posture, facial expression, or any other gesture, body language also adds significant connotations.

In the course of a person's entire existence, their personality develops, and one of the most important aspects of that process is their ability to provide and receive various types of information. In this time, communication is crucial for personal development since it helps people discover who they are, boost their confidence, and define their relationship to their surroundings.

When people are unwilling to comprehend the perspectives, thoughts, ideas, and feelings of others, efforts to develop effective communication skills will fail.

Business Related Skill

"Business related" with a rated percentage of 59.6 is one of the tops identified most difficult or demanding work skills by the 267 respondents, following People management and Communication work skills in the line of their work duty and as they also transit into leadership and managerial roles.

What is Business Skill?

Business skills comprise all of the soft skills, communication skills, management skills, project management skills, and technical abilities required for success in management and business professions.

Critical thinking, leadership abilities, problem-solving, verbal communication, effective communication, time management, public speaking, presenting, leadership, and other abilities are among the soft skills within a business skill.

The needs for various business skills will vary depending on the area of specialty. For instance, a position in staff management will call for expertise in interviewing, teamwork, and dispute resolution.

The nature of employment is fundamentally altering as a result of technology. Employees are now more likely to concentrate on business skills for strategy and advising rather for audit and compliance, which are becoming much more automated.

Even while it's advantageous to have a strong foundation in all business skills, your function in a company will determine which talents are most crucial to study. An accountant for a business, for instance, is more concerned with financial and data analysis than a project manager is with leadership and time management.

Negotiation Skill

Coming fourth (4th) in the ladder of most difficult and or demanding work skill identified by the engineer's respondents is one of the Business skills called Negotiations rated as (56.2%) on the graph as showed in table 16. As with the other three mentioned skills above, this skill is also a non-technical skill, but highly sort after in the leadership and or managerial roles as most of the time, the leaders are negotiating one thing or the other, either with the junior or senior staff, customers, suppliers and or other related firms or Government agencies.

You negotiate every day, whether you recognize it or not. The majority of this bargaining takes place around informal issues like what to have for dinner or where to go on the next family trip etc. Formal negotiation skills, on the other hand, are essential for professional success and involve coming to an agreement, making concessions, working together, thinking, and successfully communicating. And this is the reason this skill is highly essential in the leadership circles.

In his article on <https://www.usnews.com/education/learn-business-skills>, Coryanne Hicks (2020) stated that earning negotiation techniques is more about learning how to avoid conflict than it is about knowing how to win one. The finest negotiators can steer parties away from unnecessary conflict and toward a mutually beneficial arrangement. As you're more likely to know what to say, when to say it, and how to say it, being a skilled negotiator can also help you communicate more effectively.

Types of Negotiations

The two major forms Negotiations:

Integrative Negotiations: Cooperation is the cornerstone of Integral Negotiations. Both parties think they can leave with what they want without giving up anything significant. In integrative negotiations, problem solving is the predominant strategy.

Integrative Negotiation involve:

A number of issues. In exchange for concessions from the opposing party on more crucial matters, this enables each side to make compromises on less crucial issues.

Information exchange. This is crucial to problem resolution.

Construction of bridges. Integrative talks must be conducted in a spirit of trust and cooperation to be successful. (Meshram et al., 2021)

Distributive Negotiation involves a predetermined pie.

There is a finite amount to go around, and each party wants the largest possible piece. Car price haggling with a salesman is an illustration of a distributive negotiation. The parties to this negotiation are less concerned with building rapport or making a good first impression. Maintaining information privacy is a requirement of distributive relationships. In distributive Negotiation, there are:

Preserving the privacy of data. For instance, you wouldn't want a car salesman to know how much of a new automobile you really need or how much you are ready to spend.

Attempting to get data from the other person. Knowledge really is power during a negotiation. Your position in negotiations is stronger the more you are aware of the opposing party's circumstances.

Allowing the opposite side to make the opening bid. Perhaps it is just what you were going to give yourself! (Meshram et al., 2021).

Changes and Improvement Skill

The last in the top five (5) listed or identified by the Engineers on work skills that are most difficult or demanding in the line of their work duty is the "Changes and Improvement skills" bearing a 47.2% of the 267 respondents of the survey.

As stated by Rachel Breitbach, the Farwell's Practice Lead for Change Management and Agility, Organizational change happens in every company at some point, so knowing how to deal with it is an important ability. However, the change management process has become a more typical aspect of conducting business in recent years. Change management, whether you realize it or not, is a component of practically everyone's job nowadays.

What is a Change Management Skill?

A change management skill is the capacity to handle changes in order to maximize corporate growth while minimizing interruption. It entails the design and management of organizational structures, procedures, and personnel changes. A company's ability to transition to a new state and prevent costly blunders is aided by effective change management skills.

People and organizations who resist change fall behind, fail to provide the required outcomes, spend more money and time than necessary, miss out on opportunities, become obsolete, lose clients, suffer from low morale, and put off activities and initiatives. A successful manager must control change management effects for both his / her organization and for himself or herself. (Kumar et al., 2015).

One must continually reinvent and reassess themselves as they move through the stages of life and adjust to the next stage. Professional success is strongly correlated with one's capacity to adapt to change in life.

An effective leader actively pursues skills that will help him adapt to a changing environment, learn about new technologies, and get the most out of it. He seeks out regular formal and informal feedback on how he is doing, firmly believes in lifelong learning, and is aware of his flaws and talents. (Kumar et al., 2015)

The Three C's of Change Management: Collaboration, Commitment, and Communication

More than ever, firms must practice effective change management because of the ongoing disruptions brought on by the pandemic, changing economic conditions, supply chain challenges, and other factors. Do the members of your leadership team understand how to successfully implement organizational change? Up to 70% of change initiatives, according to McKinsey, fall short of their objectives.

Everybody's personal and professional lives must include change. Professional leaders must comprehend, prepare for, and manage change for both themselves and the organization they oversee. Missed chances, career stagnation, self-demotivation, poor implementation, delayed outcomes, additional costs, and marginalization of the organization are all consequences of a lack of skills to adapt to and manage change and improvement.

A competent leader anticipates change and makes adjustments for both themselves and their organization.

Having reviewed and analyzed the engineer's responses on the survey, taking into consideration how they voted on different questions. And juxtaposing that with the relationships based on their Engineering Disciplines, Ages, Sex, Roles, Additional degrees, Level of responsibilities vis-a-vis, their knowledge of soft-skills, the various challenging, difficult or demanding skills they encounter in the line of their work duty in this chapter, we will be considering some recommendations as we conclude the thesis work in the next chapter.

V. Conclusion and Recommendation

The Summary

The online survey questionnaire was conducted over a 60-day period, from April 20th to June 18th, 2023. A total of 267 engineers responded, representing about 10% of the targeted 2,700 individuals registered with the Council for the Regulation of Engineering in Nigeria (COREN), Lagos State branch, where the survey was conducted. The respondents held various positions and levels of experience across public, private, and commercial sectors within Lagos State. These professionals received training in diverse engineering specialties from various institutions. Their ages, job positions, disciplines, and levels of responsibility varied, and the group included both male and female engineers.

The proportion of respondents with advanced degrees across different fields and management levels demonstrates a growing awareness among employers and engineers about the importance of additional professional training. This aligns with a broader trend seen across professions, where formal education increasingly accompanies practical experience.

Many of the survey findings were unsurprising. The fact that the data from this 2023 survey are comparable to results from earlier UK surveys in 1979 and 2002, as well as the 2021 South Africa survey, suggests that accurate and consistent information was collected.

According to the research, while approximately 47% of respondents continue to work in primarily technological roles, most engineers' careers typically involve managerial responsibilities. A majority of respondents (63%) indicated that possessing soft skills significantly improves employment and career advancement prospects, as detailed in Table 12.

When asked about the most challenging aspects of their jobs, respondents highlighted "People management" and "Communication" as the top difficulties, followed by "Business-related," "Negotiation," and "Change/Improvement management" skills. These managerial and social skills were mentioned more frequently than purely technical skills. This underscores the conclusion that for engineers overall, management and interpersonal competencies are as critical as technical expertise.

The prominence of these challenges indicates a clear need for both engineers and their employers to recognize and address gaps in managerial skills. Since these engineers operate at various organizational levels and influence their companies' success, corporate-level initiatives should be implemented to reduce the costs associated with these deficiencies. If these concerns are unfounded, organizations need to identify why the perceptions exist and address them accordingly.

In conclusion, the survey findings are consistent with those from the UK (1979, 2002), Norway (1983), and South Africa (2021), leading to the following conclusions:

Although engineering as a profession remains primarily technology-focused, it lacks a clear and consistent role definition given 21st-century demands. Instead, it should be seen as a process with variable content.

Despite management responsibilities being integral to most engineering careers, many engineers continue to work in primarily technical roles.

Most engineers lack formal education or training in many managerial fields and skills necessary for their current positions.

The specific managerial skills and knowledge required depend on the engineer's field and job category.

Managerial skills needed vary across career stages, influenced by factors such as age, position, and level of responsibility. Early in their careers, engineers require some administrative experience, which may diminish over time.

At mid-career and beyond, managerial responsibilities tend to increase in importance and complexity.

Engineers recognize the need for further management training and experience to advance in current and future leadership roles.

Management experience and skills have become more crucial in engineering roles now than ever before.

Overall, the research indicates that even engineers not primarily in management positions must develop key managerial competencies early in their careers to progress successfully, with these demands evolving over time as responsibilities grow.

The Survey Limitations

We only examined a small sample of engineers from the Lagos branch of the Council for the regulation of engineering in Nigeria, which is simply a "snapshot" of the work at the time. There is a need for more thorough surveys to be conducted on a regular basis to assess the demands of engineers at different phases of their careers.

The timeline or duration for conducting the survey is limited, and this might not have helped to reach as many as possible, who would have participated in the survey. There's need to have a holistic and ample timeline for further surveys of this kind.

Lastly, the administrative and leadership skills needed for careers in engineering have been the main focus of the surveys. There aren't enough comparative studies of the technical aspects of their occupations, though, to offer a sound foundation for debating, prospective adjustments to curricula, training, and career development strategies will be needed.

The Recommendation

Skills Requirements

Managerial Skill Requirements for Engineers (2023 Survey Findings)

The 2023 survey focused on identifying the managerial skills required in engineering jobs. The data revealed that engineers need substantial experience in various managerial duties early in their careers and at professional levels—even if their roles are not primarily management-oriented.

Importance of Non-Technical Factors in Engineering

Engineering practice must consider human, social, ethical, environmental, political, and economic factors when developing or applying technology. Engineers who innovate must be critically aware of the power they wield. To prepare graduates and professionals adequately, there is a pressing need to redesign engineering curricula to align with today's industry demands, ensuring that graduates possess relevant knowledge, skills, and values.

Key Managerial Skills Identified

From Figure 18 (Page 60), respondents identified five top demanding work skills:

- People Management
- Communication
- Business-related Skills
- Negotiation
- Change/Improvement Management

These top skills are consistent with those highlighted in other related surveys and are predominantly non-technical in nature.

Inclusion of Soft Skills in Training: Survey questions on whether soft skills should be incorporated into professional training and taught at the undergraduate level received overwhelming support (Table 15, Page 59). This underscores the critical importance of integrating these non-technical skills into engineering education and professional development.

Additional Managerial Skills (Based on Peterson & Van Fleet, 2004)

Building on the top five skills, Peterson & Van Fleet outlined further essential skills for engineers:

Decision Making Capability: Ability to evaluate and select among competing solutions; this should complement technical training.

Human Skills: Collaboration, negotiation, teamwork, and dispute resolution within and outside the organization.

Communication: Effective transmission and reception of information, ideas, and emotions to reach consensus.

Interpersonal Skills: Building and maintaining trustful, open relationships with peers, superiors, subordinates, and external parties to foster a positive work environment.

Conceptual Skills: Seeing the organization as a whole and approaching problems methodically.

Diagnostic Skills: Identifying root causes of problems through symptom analysis.

Flexibility: Adapting to ambiguous, complex situations and changing expectations.

Administrative Skills: Following policies, timely paperwork, and budget management.

Lord Flowers (quoted by Martinec, 1984) also emphasized the importance of managerial abilities in quality control, commercial and product planning, organization, finance, labor relations, and marketing.

Recommendations for Developing Engineering Managerial Skills**A. Self-Awareness**

Self-awareness is foundational. It involves personal evaluation through 360-degree assessments, feedback from peers and supervisors, and self-assessment. Tools like personality inventories, critical thinking exercises, and emotional intelligence assessments can support this process. Engineers should map their current abilities and aspirations to guide development (Farr & Brazil, 2009).

B. Review Engineering Undergraduate Curricula

With over 71% of survey respondents advocating for soft skills instruction beginning at the undergraduate level, and around 78% supporting their inclusion in professional training, engineering education must prioritize soft skills. Institutions must embed soft skills training in curricula to better prepare graduates for the workforce and career progression (Munir, 2022).

C. Higher Education

Continuing education, such as master's programs in leadership or engineering management, helps engineers gain vital business acumen, flexibility, creative and critical thinking skills needed for leadership roles.

D. Experiential Learning

Leadership development requires experience beyond technical tasks. Engineers should be encouraged to take on challenging roles that push their interpersonal, managerial, and communication skills out of their comfort zones. This holistic growth is essential (Farr & Brazil, 2009).

E. Mentoring and On-the-Job Training

Senior managers often lack time to mentor young engineers who may not be aware of their soft skill deficits. Structured mentoring and training programs are essential to impart commercial knowledge, communication skills, and leadership competencies to junior engineers (Farr & Brazil, 2009).

F. Creating a Mindset of Continuous Improvement

Mastering soft skills is a lifelong journey. Engineers should identify weak areas, set goals, make plans, and regularly evaluate progress. They should remain open to learning, embrace feedback, and build supportive networks to foster ongoing development.

G. Support Structures

Universities, companies, and institutions must recognize the importance of soft skill development, providing time, resources, and redesigning curricula or corporate training accordingly. This might involve revised grading criteria or new course objectives academically, and mentorship, coaching, and professional development initiatives corporately (Bowman & Farr, 2000).

H. Senior Manager Expectations and Involvement

John Quincy Adams famously said a leader is one who inspires others to pursue goals and learn. Senior managers can expose young engineers to responsibilities by involving them in meetings and discussions, followed by constructive feedback to develop leadership attributes.

Final Thoughts

Many engineers lack clarity on the ideal blend of technical and non-technical skills for success. A balanced fusion of hard and soft skills is essential for long-term achievement. Given the accelerating pace of modern engineering, young engineers must develop leadership capabilities early in their careers. This benefits not only the individuals but the entire profession.

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Appendix-A

A copy of the survey questionnaire

Engineers Leadership Skills Challenges

This survey is designed to determine what skills and expertise needed in the work of a sample of professional engineers and to see whether the needs vary with engineers' ages, responsibility and branches of engineering.

Your consent is required, please tick the box to continue.

Q.1 What is the major subject of your basic educational qualification (Tick only one box)

	Tick
Aeronautical Engineering	
Building / Structural Engineering	
Civil/Construction Engineering	
Chemical / Petroleum Engineering	
Computer / Electronic Engineering	
Electrical Engineering	
Marine Engineering	
Materials Science	
Mechanical / Production Engineering	
Environmental Engineering	
General Engineering	
Others: Geotechnical Engineering, Metallurgy, Gas Engineering, Fuel Technology, Solar PV Industry, Manufacturing Systems Engineering	

Q.2 In which year did you attain this qualification? (State in numbers)

.....

Q3 How long have you been working?

1 – 2 Years	
3 – 5 Years	
6 – 10 Years	
11 – 20 Years	
21+ Years	
Others	

Q4 Hold any other Higher Degree? (Please tick one box)

PhD	
MBA /MSc	
Bachelors' Degree + Graduate Studies	
Postgraduate Diploma / Associate Degree +	
None	
Others	

Q5 While acknowledging the complexity of most jobs, do you consider the work you do as (Please tick one box)

	Tick one
Predominantly technological?	
Predominantly managerial?	
Both equally	
Don't Know	

Q6 Which of the following best corresponds to the level of responsibility which you have in your job?

	Tick one
Director / Partner	
Chief Technical Officer/ Chief Engineer /Chief Technologist/ Chief Information Officer	
Manager / HOD / Principal Engineer / Principal Technologist	
Senior Engineer / Senior Technologist	
Professional Engineer / Professional Technologist	
Engineer Graduate / Intern	
Others	

Q7 Knowledge of Soft Skills

	Agree	Disagree	Not Sure
Ever heard about soft skills before?			
Engineers should be more than technical experts. Do you agree			
Do you think that engineers are considered to be lacking in these skills?			
Do you think employers look for more than technical knowledge when they employ or promote engineering graduates?			
Would soft skills improve your employment and promotion opportunities?			
Do you think lack or insufficiency of these skills can hinder such chances?			
Should soft skills be included in your professional training?			
Should Soft skills should be taught at university from undergraduate level			

Q8 Thinking of all aspects of your job, what would you say is the one most difficult or demanding aspect of it, if any?

Most difficult aspect of your Job	Responses
Industrial relations	
Technical related	
People management	
Business related	
Communications	
Control and monitoring	
Keeping up with new developments	
Dealing with other senior managers	
Political interference, bureaucracy	
Negotiation	
Risk Management	
Improvements and change	
Project Planning / Costing	
Health, Safety and Environment	
Incidence / Fault Management	

Q9 Please give the full title of your present job (Optional)

Q10 To how many people are you directly responsible? (tick one box)

None	
1-2	
3-5	
6-10	
10+	
Others	

Q11 Approximately how many people are Employed at your own place of work ?

None	
1 - 49	
50 - 99	
100 - 449	
500 - 0999	
1000+	

Q12 Sex

Under 30	
31 – 40	
41 – 50	
50 – 60	
61+	

Q13 Sex

Male	
Female	
Prefer not to say	

Q14 Do you belong to any professional body?

Council for Regulation of Engineering in Nigeria (COREN)	
Nigeria Society of Engineers (NSE)	
Association For Consulting Engineering in Nigeria	
Nigerian Association of Technologists in Engineering	
Nigerian Association of Engineering Craftsmen	
None	
Others	

Q15 What is your opinion about the survey

Thank You Very Much for Your Help, Click Done to complete