The Critical Role of Soft Skills in Engineering: Enhancing Performance and Career Advancement

Irmohizam Ibrahim[1], Norhasni Zainal Abiddin[2]

Abstract

Today's engineering graduates seeking jobs require a combination of technical abilities and the right soft skills, as organizations prefer a professional individual who has developed an overall personality that encompasses both professionalism and alignment with society, rather than relying solely on qualifications and academic scores. The 21st-century workforce has changed the way they define job skills, with managers prioritizing non-technical (soft) skills in addition to technical skills, as having these alone is no longer enough in today's competitive market place. This article aims to analyze the significance of soft skills in the engineering sector, as highlighted in the literature review. An understanding of these soft skills is crucial for organizations to optimize the levels of productivity amongst their employees and for individuals desiring to advance their futures within a competitive job landscape. This article attempts to shed light on these soft skills in the hopes of investing in training program designs that can maximize engineers professional efficacy and career successes within their industry, engineering.

Keywords: *Soft Skills, Training, Engineer, Organisation, Career Advancement, Performance, Industry.*

Introduction

Employees need to maintain their competitive edge and enhance their soft and hard skills, including both behavioral and transferable skills. It is about traits such as communication, empathy, honesty, integrity, and sense of humor. All of these are important qualities for cooperating among colleagues and raising competency levels. Maniscalco (2010) identified soft skills as a collection of qualities, habits, personality traits, attitudes, and social graces that an individual can have to higher or lower degrees. Similarly, Devedzic et al. (2018) argue that communication skills, language, and personal habits are the soft skills in addition to personality traits, social graces, and interpersonal skills that will help you to improve the interaction with others. Similar to their degree of difficulty, hard skills are cognitive and teachable (Scheerens et al. 2020). Formal education, apprenticeships, or specific training sessions typically acquire hard skills, also known as technical skills (Bartel, 2018).

Soft skills play a vital component to communication, teamwork, problem solving, and relationships with both colleagues and clients (Devadason, Subramaniam & Daniel, 2010). Furthermore, they help keep the next generation in check and adapt to a world that morphs on a regular basis due to the rapid evolution of technology (Dean, 2017). Since the 1990s, when data began to show that soft skills were often more important than hard skills in the work pace (as Young (2018) highlights), their importance has risen further. Soft skills are in high demand, particularly because they can significantly impact how we perform in our jobs and can be critical to an organization's success. These are not industry-specific, but rather general skills that everyone needs (Anthony, 2014). In engineering surveys, particularly, soft skills defined as leadership, teamwork, creativity, communication, and problem-solving skills are the most critical factors in improving overall performance (Afroze et al., 2019). Engineering roles no longer solely focus on technical skills and performance; they now require a blend of teamwork, critical thinking, and multitasking.

Issues on Soft Skills in Engineering Sector

Despite the widespread realization of the significance of soft skills, many graduates and professionals in engineering are still not proficient in such areas, which has adverse effects on their job performance (under pressure), teamwork, client dealings, and career endeavors. Furthermore, as the roles of engineers evolve

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[1] National Defence University of Malaysia
[2] National Defence University of Malaysia, Email: norhasni@upnm.edu.my, (Corresponding Author)

to include more cross-functional collaboration, client interaction, and management responsibilities, the need to train these soft skills through tailored programs is vital. Furthermore, achieving adequate alignment of these skills is crucial for enhancing employee performance and ultimately contributing to the success of an organization (Ibrahim, Boerhannoeddin, & Bakare, 2017).

Although the demand for top talented engineers is increasing, technical skills alone are probably not enough (Ismail et al., 2019). The guarantees engineers require in order to maintain their presence, career indictment, and values are soft skills due to the global open market economy (Esa et al. 2015). It is important for engineers to appreciate the weight of soft skills in their career advancement within the current economic landscape worldwide. Consequently, there is a growing need to develop soft skills training programs for engineers in order to improve their job performance and professional effectiveness (Galimullina et al., 2020).

Today, soft skills are as important as hard skills, and employers look for a blend of the two in potential employees. According to Dean (2017), most employers not only require employees to possess soft skills acquired through classes and previous jobs, but also require them to demonstrate these skills. The workforce has become increasingly diverse, and the ability to communicate effectively with people from different cultures, using the communication skills learned in the course, is crucial for the online work environment. An organization should provide an organized and suitable training program that resonates with its employees in terms of useful soft skills development.

Soft skills such as communication, teamwork, leadership ability, problem solving, and adaptability also play important roles in engineering projects. These have the potential to facilitate communication, as well as high-order thinking and real-world problem-solving skills, but perhaps they are among the more prized capabilities that make a new graduate employable in an increasingly competitive market (de Campos et al., 2020). Project Management: Skills are vital for implementing projects, selling an idea, coordinating resources, and succeeding. Additionally, they excel in communication, collaborate easily, and adjust to changing circumstances, thereby simplifying and enhancing the project delivery process. It also influences the display of soft skills, which can significantly boost employability and even improve performance (Abiddin, 2007).

Despite the growing recognition of the importance of soft skills in the professional environment, industrial engineers (IE) in Malaysia, particularly those in the automotive sector, often lack proficiency in these key qualities. The intense competition in the automotive industry often leads engineers to prioritize technical skills over crucial soft skills known as the 5Cs (communication, collaboration, critical thinking, change adaptability, and creativity). However, a significant number of engineers lack proficiency in these areas, which can negatively impact their work performance and potentially hinder their success in leadership roles, customer interaction, or collaboration. The tape contains top drivers for success in a requirements analysis space that is both high velocity and innovation intense (Kyllonen, 2013; Dean, 2017). One of the biggest hindrances to an engineer's ability to function more effectively and achieve success in industry careers is the inability to master soft skills. Communication, leadership, and teamwork deficiencies particularly cripple cross-functional teams, so critical to automotive product development. Conversely, this absence of softer skills causes internal conflicts and coordination issues between departments, which in turn have a negative impact on making decisions, performing collaborative initiatives, and eventually leading projects to successful completion (Iosifidou 2024).

When it comes to soft skills, their impact on performance has been established and debated for years; however, it is still up in the air as to how specific training programs lead to their development and how well the workplace shapes or suppresses them. By studying this gap, future efforts can lead to new and improved training programs focusing on the soft skills necessary for an engineer to do their job more efficiently, which could help bridge current industry shortcomings.

Literature Review

Soft Skills

Soft skills are a set of qualities, habits, personality traits, and attitudes used in everyday life for functioning on the job (Ibrahim et al., 2017). Coelho and Martins (2022) define non-cognitive skills as the core set of abilities required for constructive social interaction in the work context. These define a trait, describe how someone behaves, what they like or dislike to do, and whether they are introverted or extroverted, all of which determine if someone is hardworking enough, the right fit, and will get along with colleagues (White, 2021). Frequently undervalued, a person without these special skills can't really be the effective team member you want them to be.

The soft skills are becoming more and more important in the engineering profession; the literature mentions that they have a significant role for improving the efficiency and employability of engineers (Ibrahim et al., 2017). The results of the studies point to the need for soft skills development training programs aimed at engineers. This underscores the importance of these programs in enhancing work performance outcomes (Coelho & Martins, 2022; Kyllonen, 2013). Previous research delves deeper into the soft skills engineer's value most and their perceived proficiency in these areas, providing a potential roadmap for improvement (Gupta & Tiwari, 2021). Nonetheless, this leaves open the question of the mechanisms through which a training program improves engineers' soft skills and work performance metrics—an issue that requires deeper investigation (Ubfal et al., 2022).

However, the studies' reliance on self-reported data from engineers might be a potential limitation, as the information presented may not be accurate due to bias. Nevertheless, self-reported data is a widely used methodology within the social science context, often leading to important discoveries concerning employees perceptions and experiences. Soft skills development is important for engineers because it is required for professionals' career progression and success. Evidently, the availability of strong soft skills allows engineers to operate within a complicated working environment, successfully communicate with colleagues and stakeholders, resolve conflicts, effectively perform in teams, exercise leadership, and efficiently deal with problems. In the meantime, soft skills may be overlooked by many educational facilities due to a lack of time, and this factor could be critical as the prescriptive curriculum may not consider contemporary industry demands.

Introducing a training program within the regular curriculum implementation is crucial. This involves integrating actual industry-based problems, addressing them with soft skills, shifting the workload minimally, and using a person-specific approach. This approach ensures continuous development of values, attitudes, and soft skills. Therefore, engineering educators should consider integrating industry-relevant soft skills in their programs to align graduates with the industry. Soft skills are the skills that help individuals to collaborate with others, manage their workload, and react to inevitable strain.

Soft skills are difficult to recognize, quantify, and evaluate. However, all organizations value certain skills like punctuality, decision-making, cross-cultural collaboration, and language learning. Previous researchers have found from Table 1 that future employers require soft skills to hire technical students in the industry. These skills are also essential for students to live and succeed in a competitive project-based job market. Furthermore, employing technical students with such skills is likely to enable them to face the obstacles of today's career with a discerning mind and never yield.

Table 1. Past Studies of Soft Skills in Engineering

Soft Skills in Engineering	Technical Skills	Meta-cognitive Skills	Intra-personal Skills	Inter-personal Skills	Problem-olving Skills
Kohnova & Papula (2019)	/				

Gibb (2014)	/				
de Campos et al. (2020)	/				
Gibson and Zellman (2013)	/				
Caeiro-Rodriguez et al. (2021)	/	/	/	/	/
Ibrahim et al. (2017)	/	/			
Bielefeldt (2018)	/				
Guner & Erbay (2021)		/			/
Bhatpahari (2021)			/		
Angeles (2012)			/		
Febrianita & Hardjati (2019)				/	
Hirudayaraj et al. (2021)				/	
Mitsea et al. (2021)		/			

Soft Skills in Engineering

Management previously focused on hard skills; this focus was about the performance-based technical abilities (Gibb, 2014). Generally, these skills aligned more closely with the tasks at hand. But all jobs today require someone to have certain qualities. Also, soft skills are transferable from one job to the next. While a variety of career fields require people skills for advancement, transitioning to a new field necessitates relearning most technical skills (Das & Sharma, 2020). Nowadays, business is all about humans. It involves communication, building relationships, and representing oneself or the company in a positive and unique way.

In the engineering industry, working with engineers means that you need more than technical know-how for them to operate efficiently. Important soft skills identified for engineers include communication, teamwork, leadership, problem-solving, and adaptability (Gibson & Zellman 2013). These soft skills are invaluable in more multidisciplinary teamwork, translating technical information to non-specialists, and adjusting to project modifications during its development. According to the Human Resource Development Fund (HRDF) human capital report (Semi-HRDF, 2019), a technical role will always reveal who is good and who is exceptional, regardless of the position.

Creativity, persuasion, collaboration, adaptability, and time management top the list of skills companies need most in 2019, according to LinkedIn Learning. HRDF (2019) also suggested that a combination of hard and soft skills could enhance the significance and desirability of these skills. For this reason, it is crucial for engineers to use soft skills like communication, teamwork, problem solving, and leadership to sharpen their strong iron beauty throughout their professional journey. Higher Education through Active Learning

for Growth (HERA) identifies the key soft skills for engineering as technical skills, metacognitive skills, intrapersonal skills, interpersonal skills, and problem-solving (Caeiro-Rodriguez et al., 2021).

Technical Skills

Technical skills, which are part of a regular engineering curriculum and are related to the technological field. The same applies to skills such as specific data entry or programming abilities, proficiency with specific tools or equipment, and expertise in particular engineering domains. The HERA project assigned high importance to technical skills such as digital literacy, global awareness, and information and media literacy (Coelho & Martins, 2022).

In the digital era, engineers need to be well-acquainted with many of the digital tools and technologies to elaborate solutions through design, development, right up to execution. Digital literacy skills enable engineers to make maximum use of technology, thus accelerating their productivity and improving their innovation quotient. Digital literacy skills are essential for engineers to communicate across geographical distances with their colleagues and stakeholders (Coelho & Martins, 2022).

As previously discussed, an international worldview is essential for engineers so that they can understand and identify the wide variety of cultural, social, and economic imbalances found in many parts of the world. This is an important issue because engineers commonly work on projects that require the involvement of different stakeholders across the globe. Create global awareness: This will enable engineers to comprehend the needs and knowledge of various stakeholders. Their increased understanding then allows them to design and implement solutions that are both culturally appropriate and more effective. This way, they will be more effective at working in heterogeneous teams and communicating with other engineers from different cultural, technological, disciplinary, and organizational perspectives (Coelho & Martins, 2022).

Engineers need to acquire skills for reaching, sizing, and using information in ethically acceptable ways. Gaining information and media literacy opens the door for engineers to critically assess the kind of information that emanates from different sources. This capability, in turn, aids in making intelligent judgments and designing the most economical and successful solutions. Additionally, engineers must possess information and media literacy skills to effectively communicate their ideas and solutions to diverse audiences (Kohnova & Papula, 2019).

Engineers, as gatekeepers of the public good, also hold in their hands the health and safety of literally billions. To design safe and healthy solutions for their users or the environment, engineers need a basic level of health and wellness literacy (Ibrahim et al., 2017). Additionally, with their knowledge of health and fitness, these engineers are better equipped to promote a healthy lifestyle among future users of their smartwatch-assisted solutions. Engineers have an ethical responsibility to employ ethical solution design as well as responsible innovation. When engineering standards are based on moral principles, engineers can exercise judgment consistent with fairness, justice, and respect for human rights and the environment. Engineers with an ethical backbone are also better equipped to identify and address ethical dilemmas that may arise in practice (Bielefeldt, 2018). Engineers need to understand the impact their work will have on capital. Engineers' solid knowledge of economics and finance allows them to design economically competitive and profitable solutions. Furthermore, with a basic understanding of economics and finance, engineers can identify and mitigate any economic and financial risks associated with their work.

Engineers should possess a solid foundation in the fundamental concepts of engineering. An elementary knowledge of different engineering fields helps engineers understand what essential concepts are required in their work (Bielefeldt, 2018). They use this knowledge to effectively apply the principles when thinking through and executing solutions. In addition, engineers with a strong theoretical and basic engineering knowledge learn new technologies faster and adapt better to the best practices in their field. Table 2 describes the skills in the technical skills category.

Table 2. List of Skills in Technical Skills Category

Skill	Description
Digital literacy	Ability to locate, assess, and articulate coherent information via writing and other media across diverse digital platforms
Health and wellness literacy	Ability to acquire, analyse, and comprehend fundamental health information and services necessary for making informed health decisions
Global awareness	Ability to comprehend, honour, and collaborate effectively with others from varied cultural backgrounds
Information and media literacy	Ability to demonstrate and formulate educated judgments as consumers of information and media, as well as to become proficient developers and producers of information and media messages
Ethics	Ability to comprehend, implement, and evaluate the ethical standards that regulate an individual's conduct or the execution of an academic and/or professional endeavour
Economic and financial literacy	Proficiency in and application of the essential principles of mathematics, economics, business, and related disciplines necessary for pursuing a career in economics
Engineering knowledge	Proficiency in and application of the essential principles of science, technology, engineering, and mathematics (STEM) necessary for pursuing a career in engineering

Source: Caeiro-Rodriguez et al. (2021)

Metacognitive Skills

As a result, metacognitive skills include self-regulation and enhancement of cognitive processes. These traits are necessary to be able to give someone with a different educational path the best chance of becoming an outstanding performer (Guner & Erbay, 2021). Metacognition is comprised of the cognitive components of self-awareness and self-control that allow individuals to control what they think well enough to achieve learning goals. Other positive features and characteristics include critical thinking, analyzing information from different sources, a desire to learn, being self-regulated, reflective, and the ability to manage time.

Critical and analytical thinking is the ability to make systematic judgments based on disparate information taken from numerous resources, as well as appropriately spot patterns and correct relationships among them. 'Evaluating information from a wide range of sources' is considered the ability to critically assess and evaluate information, which is research from different media, especially online resources, for confirming if they are genuine and reliable (Guner & Erbay, 2021). Willingness to learn, in loose terms, means disposition towards qualitatively acquiring knowledge and doing so with an open mind, while also welcoming new ways of perceiving things. Self-regulated learning carries the capacity to set goals, gauge progress, and change learning strategies as one sees fit in order to achieve those learning objectives. Reflection is a cognitive process that requires an introspective look at our own learning experiences in order to improve the quality of learning. Time management also includes the discipline to effectively control their time and set priorities while working towards educational goals.

To effectively learn about emerging technologies within their domain, engineers need to acquire and use highly valued metacognitive abilities (Ibrahim et al., 2017). In addition, the development of metacognitive capacity is critically important for engineers to both recognize and deal with complex problems effectively, as well as to work efficiently in interdisciplinary teams. Table 3 lists the selected skills for the metacognitive skills category.

Table 3. List of Selected Skills for Metacognitive Skills Category

Skill	Description
Independent and autonomous learning	Ability for independent and autonomous learning.
Willingness to learn	Willingness to acquire new knowledge and enhance oneself.
Integrating and synthesizing information	Ability to analyze, synthesize, and produce a coherent message derived from several, occasionally contradictory, information sources.
Evaluating information particularly when coming from diverse sources	Ability to critically assess the dependability, validity, accuracy, timeliness, perspective, and bias of information sources.
High-level thinking	Ability to utilize all prior skills, specifically analysis, assessment, and synthesis/creation of novel information.
Critical and analytical thinking	Ability to deconstruct intricate knowledge into essential components and evaluate and appraise such information.
Innovative thinking	Ability to analyze problems or situations from an innovative perspective that may yield unconventional solutions.

Source: Caeiro-Rodriguez et al. (2021)

Intrapersonal Skills

Interpersonal skills involve an individual's inner qualities and general disposition in different situations. Therefore, it is essential for an engineer to acquire these skills or abilities, which will help them attain the optimum level of effectiveness and efficiency during their professional life. Furthermore, the control theory allows them to effectively manage their emotions and behaviors, which ultimately results in a positive attitude towards work. Intrapersonal skills involve receptivity to diverse perspectives and viewpoints, assertiveness, willingness to receive constructive criticism and feedback, adaptability or flexibility, and commitment to excellence in the quality of work produced. These skills encompass effective planning and planning abilities, creativity, self-discipline, perseverance, and proactive initiative. Open-mindedness is a cognitive attitude or trait that allows you to be receptive and willing to hear new ideas, other points of view, or consider various viewpoints. Openness to alternative perspectives and opinions comprises the capacity to receive feedback or suggestions and collaborate with other people (Abiddin et al., 2022; Bhatpahari, 2021).

The art of communicating one's point of view and ideas in a clear, non-invasive, and assertive manner without stepping on others' toes is crucial. In essence, this refers to the ability to openly disregard criticism and feedback, utilizing it to enhance personal performance. Most of all, flexibility and adaptability are the keys to being able to change to whatever comes your way. In addition, they involve the ability to work efficiently in different working environments. The understanding of the subjective quality of work stems from a steadfast commitment to producing outstanding work, as if it were its own reward (Angeles, 2012). Planning is the art of creating a work breakdown structure and gathering things in order to move towards an objective. The skill of prioritization is best described as the ability to categorize tasks and activities in terms of their importance and urgency.

Creativity is a cognitive process that involves divergent, bottom-up thinking to generate original ideas and solve problems that differ from convergent forms or conventional perceptions. It refers to the capacity to think beyond established norms and discover innovative solutions to problems. Initiative means being able to take the lead, initiate action, and be aware of and pursue opportunities in your professional life. Self-control is defined as self-regulation in terms of behavior and emotion, including focused attention and effort under challenging conditions (Bhatpahari, 2021). Perseverance requires one to persevere through adversities and setbacks while maintaining a positive attitude towards their efforts. Engineers can cultivate several non-technical skills to enhance their performance in this field, which significantly contribute to their ease of work. These skills enable an engineer to regulate their own emotional responses and behaviors, as

well as maintain a constructive and positive approach to what they are doing in their role. In addition, intrapersonal skills help engineers work well in cross-functional teams and communicate effectively with colleagues and stakeholders. As a result, Table 4 presents the selected skills for the intrapersonal skills category.

Table 4. List of Selected Skills for Intrapersonal Skills Category

Skill	Description
Open-mindedness	Ability to be open to a diverse range of ideas, arguments, and facts.
Creativity	Ability to discern the surroundings, identify concealed patterns, establish connections among ostensibly unrelated data, and formulate solutions. Ability to transform innovative concepts into tangible outcomes.
Flexibility and adaptability	Ability to adjust to evolving situations and surroundings, as well as to embrace novel ideas and concepts.
Openness to criticism and feedback	Ability to receive bad remarks regarding oneself or one's work without exhibiting excessive emotional reactions.
Openness to others' ideas and thoughts	Ability to entertain ideas and perspectives that differ from one's own.
Initiative	Ability for autonomous evaluation and initiation of tasks.
Perseverance	Ability to endure in a course of action, objective, condition, etc., particularly in the face of challenges, hindrances, or discouragement.
Self-direction	Ability for autonomous decision-making and self-organization of tasks, rather than receiving directives from superiors, such as managers or educators.
Self-discipline	Ability for self-discipline to establish explicit objectives and diligently pursue them daily.
Planning	Ability to precisely identify and arrange systems and resources (including time) necessary for the efficient completion of a task.
Ability to prioritize	Ability to discern essential activities and resources while systematically establishing priorities, distinguishing between urgent, significant, and trivial procedures.
Assertiveness	Ability to articulate thoughts, emotions, and convictions in a direct, honest, and suitable manner.
Being positive	Ability to concentrate on aspects under one's control.
Sense of quality of work	Ability to evaluate, assess, and critique a work in a manner that results in an enhanced iteration of that work.

Source: Caeiro-Rodriguez et al. (2021)

Interpersonal Skills

Interpersonal skills are a combination of attributes that enhance our ability to collaborate effectively with others. These soft skills are essential for engineers as they help to make interdisciplinary work smoother, support effective communication with colleagues and stakeholders, and create strong partnerships with clients or end-users. Interpersonal skills include a wide variety of skills, but they all help individuals communicate and interact successfully with others. These skills include collaboration and teamwork, the ability to deliver oral presentations, active listening skills, proficiency in both spoken and written communication, the ability to apply information in practical contexts, and success in social interactions, specifically the empathy-associate ability (Febrianita & Hardjati, 2019).

Collaboration and teamwork refer to the capacity to collaborate with others towards a shared objective, while also contributing to the accomplishments of a team. Communication skills consist of a range of forms related to both written and oral presentations. In its own form, listening embodies both active listening and the ability to comprehend different perspectives and requirements. For instance, the dimensions of 'oral communication' and 'written communication' encompass the ability to communicate effectively both orally and in writing, along with the ability to adapt communication style to a diverse range of audiences (Hirudayaraj et al., 2021).

Additionally, transferring knowledge into practical fields requires skills, specifically the ability to apply the acquired knowledge and abilities effectively in real-life situations. It also implies the ability to convey that knowledge effectively to others. These include social interaction and empathy, which involves understanding the emotions and necessities of other life forms. In broader terms, leadership is the ability to marshal and direct people toward a common objective while also nurturing their personal best qualities, so they are likely to become well-developed adults. Consequently, interpersonal skills are crucial for engineers as they enable effective teamwork with interdisciplinary teams, clear communication between colleagues and stakeholders, and strong relationships between clients and consumers. Engineers also require an interpersonal skill for understanding and dealing with the needs and views of multiple stakeholders while building rapport and trust with clients or customers. Table 5 presents a summary of the skills in the interpersonal skills category.

Table 5. List of Selected Skills for Interpersonal Skills Category

Skill	Description
Social interaction and empathy	Ability to comprehend the emotions, thoughts, and behaviors of others and to convey your own emotions, thoughts, and behaviors in response.
Being a listener	Ability to intentionally concentrate on the speaker's message and get a profound comprehension of that message.
Collaboration and teamwork, sometimes in multidisciplinary teams	Ability to collaborate well with individuals on shared tasks to achieve a specific objective.
Leadership	Ability to coordinate and inspire individuals to achieve a common objective.
Oral and written communication	Ability to articulate one's ideas clearly and succinctly, while simultaneously generating focus, enthusiasm, and passion.
Transferring knowledge to the real world	Ability to utilize the attained knowledge, abilities, and competencies in an alternative setting or manner.
Presentation skills	Ability to convey information succinctly and efficiently to a targeted audience.

Source: Caeiro-Rodriguez et al. (2021)

Problem-Solving Skills

Problem-solving skills are one of the most important soft skill categories for engineers. These skills enable engineers to solve problems by understanding their origins and, crucially, devising effective solutions. Humans solve problems by motivating others, transmitting knowledge and information, planning and prioritizing resources, and demonstrating the power of a particular idea from the beginning to the end of a project (Guner & Erbay, 2021). The common-area term, problem-solving skill, received the highest score, primarily because it encompasses all other subcategories. Other under expressed competencies included defining, landing, and measuring a solution; project management; time management; creating options and evaluating them; structuring complex situations (problem defined); and park bench—the factors contributing to an undesirable situation. Slightly less so, but still with measurements fairly close to the average of the larger ensemble, working with constraints/in context limits and systemic design.

Engineers must have strong problem-solving skills in order to identify and approach complex problems with a clear, effective process. Without problem-solving skills, engineers struggle to complete assigned tasks, particularly when faced with complex problems that demand creative and innovative solutions (Guner & Erbay 2021). Problem-solving skills are also essential for engineers to work in teamwork across disciplines and departments and communicate with colleagues, stakeholders, and clients effectively. To sum up, problem-solving skills are one of the most important types of soft skills for engineers. If engineers lack such skills, they might find it difficult to identify and resolve complex problems in an organized and efficient way, which are crucial in the engineering process. Table 6 describes the chosen skills for the problem-solving skills category.

Table 6. List of Selected Skills for Problem-Solving Skills Category

Skill	Description
Problem-solving	Ability to comprehend an issue, systematically employ generic or ad hoc procedures to derive solutions, discern the most appropriate options, and evaluate them.
Providing clarity to problems	Ability to analyze an ambiguous issue and determine appropriate objectives for its resolution.
Analysis of the factors that contribute to an unwanted situation	Ability to discern events, conditions, or other factors that precipitated an urgent reason for an unfavourable situation.
Following systematic design processes	Ability to comprehend and implement techniques that integrate systems thinking and human-centered design to address intricate design projects.
Designing and evaluating alternative interventions towards solving a problem	Ability to utilize strategies to develop and assess viable solutions to solve a problem.
Implementing and assessing the effectiveness of a solutions	Ability to execute the solution and assess the outcomes from an efficiency perspective.
Working with limited resources	Ability to formulate a strategic plan and execute decisions in response to evolving circumstances and demands that result in resource constraint.
Time management	Ability to strategize and allocate time among designated activities.
Project management	Ability to strategize, acquire, and implement a project while optimizing the utilization of all resources.

Source: Caeiro-Rodriguez et al. (2021)

Discussion

A few decades ago, defining the skills needed for an engineering career would have been as simple as demonstrating proficiency in technical capabilities without hesitation. Soft skills are part of a non-technical/multidimensional range of capabilities, including communication, teamwork, flexibility, critical thinking, leadership, and also EQ, that are important in contemporary working environments for optimal job performance (Noah & Aziz 2020). In the changing world of engineering, especially as it concerns the automotive industry, the requirement for soft skills has further come to light.

The increasing complexity and interdisciplinarity in the engineering field is driving the need for soft skills. Engineers must possess strong communication skills to work with multiple teams, deliver projects, and interact with clients and stakeholders. In a fast-evolving space like the automotive industry, there is always fierce competition, and things get redundant very quickly. Soft skills are the only thing that distinguishes between an average engineer and a successful one. Research demonstrates that many engineers lack the soft skills essential for their job, resulting in inefficiencies in their job performance.

Soft skills and work performance have a long history of scholarly papers emphasizing their importance in improving job outcomes. In the study by Watermeyer et al. (2017), Ibrahim et al. assert that the acquisition of soft skills enhances work performance, especially when they come from training programs that effectively teach these skills. A study on this subject has revealed that soft skills such as communication, teamwork, and leadership directly influence an engineer's ability to meet job demands and achieve career success. Gibb (2014) further reinforces this, arguing that while we understand the importance of soft skills in entrepreneurship education, their assessment and development can be challenging due to their context-specific and subjective nature.

Gibb (2014) emphasizes the necessity of conducting cross-contextual research to investigate the scope and characteristics of soft skills, as well as their reliable measurement across various sectors. This is especially true for the automotive world, where different skills will apply in soft form to different jobs. The research also sheds light on the controversy over what are or should be considered soft skills, making it even more difficult to include them in official training programs and school curricula. Despite these challenges, studies demonstrate a positive correlation between soft skills and the performance of engineering work. If you are an engineer with excellent soft skills, you will be better placed to deal with the rapid pace of changes today, optimally adjust, and deliver productive teams. Nonetheless, this lack of a common soft skills definition and measurement approach is one of the main obstacles facing the development and assessment of this set of skills, particularly in industries that have always valued hard or technical proficiency more than interpersonal capabilities.

More broadly, such programs have been uneven in their implementation, and engineering students graduate with a deficit of the type of social skills that might make them more attractive to potential employers. Caeiro-Rodriguez et al. Jin et al. (2021a), building on the findings from Table 1, address the issues related to introducing soft skills into engineering curricula, given the controversy surrounding their concept and the lack of training for academic staff to effectively deliver these skills. This void in engineering education becomes particularly problematic in Malaysia, where the automotive sector plays an integral role in our economy's growth, but we cannot produce sufficient numbers of engineers with the soft skills needed to succeed in this dynamic industry.

Soft skills challenges require innovative soft training approaches. Soft skills development: Online learning platforms like MOOCs (Massive Open Online Courses) and game-based learning are also proving to be a promising option for the scalability and cost-effectiveness of soft skills education interventions (Coelho & Martins, 2022). They provide realistic environments where engineers can train and hone their soft skills in a non-threatening way. Finally, research has proven the effectiveness of problem-based learning (PBL) in fostering soft skills in higher education. Tadjer et al. (2022) describe PBL as a type of intervention that instills critical soft skills in engineering students, such as communication, time management, and initiative, that are critical to the success of the automotive industry.

Workplace cultures either support or erode the ability to facilitate soft skills in the high-pressure, fast-paced automotive industry. By fostering a positive environment that promotes teamwork, communication, and constant learning, engineers will more easily pass the inevitable challenges of industry and maintain high performance in their work. Conversely, a negative work environment that lacks open communication channels and supportive working conditions centered around hierarchies results in lower employability scores.

Van Heerden et al. and McKenny et al. (2023) provide us with an example of some of the barriers to soft skills enhancement in industries where technical has been king. For example, the ambiguity of definitions and poor explanations of the value of soft skills have slowed their adoption in the construction industry. The same issues could exist for the automotive sector, where an emphasis on technical expertise supersedes soft skills. To overcome these impediments, engineers need a more sophisticated understanding of how to structure the work environment to promote continuous development and use of soft skills.

The literature on soft skills still needs to widen the boundaries of research methodologies in order to innovate with training methods and adapt them according to industry demands. There is a need for more robust strategies to incorporate soft skills training into engineering education, particularly in methods that are across different fields of industry. Furthermore, workplaces in the automotive industry need to be designed to facilitate and promote engineers' use of soft skills over time.

Conclusion

In summary, this article makes a significant contribution by providing a good perspective on the importance of soft skills in the engineering profession. It has also shed light on the need for more soft skills training in engineering education to prepare graduates with the skills expected by today's workforce. The search for literature on soft skills issues, their significance, and their demand in the engineering sector shaped the scope of this study. Therefore, we aimed to share the findings with relevant stakeholders such as public and private organizations, ministries of concern, and engineering departments, to enhance the planning and promotion of soft skills training programs. Recognizing the pivotal importance of these abilities in enhancing employee execution, associations can create better-prepared procedures, leading to further significant operational accomplishments. It also acts as a guide for educational institutions in tailoring their curriculum to meet industry requirements.

In practice, the research would have far-reaching effects on employees. This gives an understanding of how important it is to have a skill set rather than just knowing what we have learned, especially for employers. Based on a literature search, this can assist engineering students and professionals in better preparing for the recruitment process and career advancement. It can make them aware of the expectations of their employers, providing valuable insights into the skills they need to strive for. In general, this research can be helpful for the employability and professional success of engineering graduates at the industry level, which is mutually beneficial for both industries and individuals.

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