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RESEARCH ARTICLE

SHAPING THE FUTURE: EXPLORING THE UNTOLD REALITIES OF ENGINEERS' JOURNEYS THROUGH INNOVATION

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Abstract

Engineering requires more than technical skills—it also depends on teamwork, communication, and adaptability. This study explores how engineers' lived experiences reveal both opportunities and challenges in driving innovation and solving real-world problems. Methodology: This qualitative study used phenomenology as its research design, utilizing structured interviews to explore how individuals became and thrived as engineers. It aimed to answer: What characterizes the role of engineers in innovating and solving problems? and How do lived experiences highlight both the opportunities and challenges of their work? Results: Three major themes emerged: Career Progression, Work Adaptation, and Team Collaboration. Career Progression includes skill application, goal motivation, and career transition. Work Adaptation involves task organization, plan execution, and challenge resolution. Team Collaboration covers workplace cooperation, mentorship formation, and technology adaptation. Discussion: Career Progression highlights personal and professional challenges, such as shifting goals and applying skills in demanding roles. Work Adaptation focuses on handling task complexity, time constraints, and unexpected issues, showing engineers' resilience. In contrast, Team Collaboration reveals opportunities—through mentorship, shared knowledge, and evolving technology—that enhance creativity, problem-solving, and innovation. Conclusion: This study highlights that career growth, adaptability, and teamwork shape engineers' capacity to innovate and solve problems. Supporting these areas through mentorship, collaboration, and lifelong learning is essential in today's evolving field.

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Introduction:-

Engineering studies have traditionally emphasized technical proficiency, equipping learners with the hard skills needed to design and implement solutions. However, success in today's complex and rapidly evolving world

requires more than technical expertise; engineers must also possess strong communication, collaboration, and leadership skills to thrive in diverse, interdisciplinary environments (Brunhaver et al., 2017). Despite this need, a significant gap remains between the skills emphasized in academic settings and the evolving demands of the industry, revealing a disconnect that poses ongoing challenges to engineering graduates and professionals alike (Johnson & Clark, 2020).

Modern engineering roles offer rich opportunities for innovation and impact, yet they also present practical challenges such as team integration, workplace collaboration, and personal sustainability in high-pressure environments. To address these, engineering programs are increasingly incorporating soft skills training alongside technical education, aiming to produce professionals who are both technically competent and adaptable in team-based, real-world scenarios (Sullivan & McLean, 2021). This shift is critical in ensuring that engineers are prepared to tackle not only technical problems but also social, organizational, and leadership challenges inherent in large-scale projects.

Research highlights that diverse perspectives and interdisciplinary teamwork enhance problem-solving capabilities and career satisfaction (Williams & Foster, 2021; Moirano et al., 2019). However, engineers often struggle to balance professional growth with workplace demands, leading to stress and burnout if sufficient support systems are not in place (Nguyen & Patel, 2022). Factors that influence collaboration—both positively and negatively—such as communication dynamics, project complexity, and team diversity, have also been identified as central to professional outcomes in engineering (Lofgren, 2020; Green & Mitchell, 2023).

This study explores the lived experiences of engineers, focusing on the opportunities that foster innovation, collaboration, and growth, as well as the challenges that hinder their professional development and well-being. By examining these experiences, the research aims to offer practical insights into how engineering education, workplace practices, and organizational support systems can be restructured to better equip engineers for success in an increasingly dynamic and interdisciplinary field. The findings will contribute to a more holistic understanding of what it takes for engineers not only to succeed but to thrive in their careers.

Methodology

This phenomenological study seeks to discover both the opportunities and challenges of how engineers' lives and pasts influence their professional practices and potentials (Devika, 2016). The qualitative research approach, grounded in the phenomenological paradigm, actively considers the sequence of events in an individual's life within the specific contexts of their lived experiences (Tenny et al., 2022). The study's framework is organized around the idea that professional background and experience significantly influence the ways people perceive and respond to different situations, drawing on both phenomenological research methodologies and studies of engineering practices and engineers' experiences (Dovetail, 2023).

A purposeful sampling method was designed to capture a wide range of perspectives. Data were gathered through semi-structured interviews, allowing participants to share their experiences and transformations. By analyzing the data in depth—especially using thematic analysis—key themes and trends would emerge and be linked to participants' insights (McCombes, 2019). To ensure the precision of the findings, the researchers utilized strategies such as member checking and triangulation. The ethical concerns would be considered top priorities from the very start, including the consent of participants, confidentiality, and a possibly biased approach. By utilizing this integrated approach, which investigates the successful integration and practical implications of engineering skills, the study hopes to provide crucial insights into the life realities of engineers and their potential for professional survivability (Denison, 2023).

Research Locus and Sample

This study offered a comprehensive examination of the engineering landscape in Doha, Qatar. The researchers selected participants—engineers employed in Doha—from various engineering disciplines. A total of 10 Qatar and the Philippines-based engineers, five males, and five females, were chosen as participants. Purposeful sampling is used in this qualitative research. This study examines how engineering students view problem-solving tasks, envisioning the future, and the connections between the two (Kim & Bensoni, 2018). The participants for this research were selected based on the following criteria: (1) is currently pursuing or has completed at least a bachelor's degree in Engineering fields. (2) is employed or has served in the company as an engineer. (3) Has at least 5-years experience in engineering fields, including professional and practice engineers in the fields of Mechanical, Civil, Electrical, and Architecture is intentional, as these disciplines are central to the study's focus on infrastructure-related practices. By concentrating on these fields, the study captures professionals who actively engage with the practical and applied aspects of engineering in real-world settings. The established criteria were closely followed to ensure that participants' rightful views and perspectives accurately represented the engineering professions.

Data Collection and Ethical Consideration

In this research study, the data collection was undertaken by creating interview questions based on the central and specific questions. These questions were then validated by selected teachers with relevant expertise in Philippine School Doha. After validation, participants were emailed consent forms inviting them to take part in the study. The date and timings of the interview were based on the participant's availability, and the interview was conducted using a Zoom application.

Robotfoto and an interview guide were used during the conducted interview. The participants were given an overview to explain the interview process. The interviews were recorded with the participant's consent using a zoom recording feature. The researchers asked for permission to record the meeting for transcription. By following the qualitative research process, the researchers analyzed the data along with the transcription of the participants' responses. The participants' confidentiality was maintained in the transcription by using labels as P1, P2, P3, and so on instead of their names.

Data Analysis

The so-called semi-structured interview is a flexible interviewing method that offers a compromise between structured and unstructured interviews. Despite having more discretion than a completely organized interview, it still follows specific rules and restrictions to preserve the accuracy and consistency of the information gathered (Jouw, 2024). The data was collected from the participants' answers in the semi-structured interview by the interviewer, who listened and reviewed the audio footage several times to be absorbed in data collection.

This study aimed to discuss the essential choices made before and after the following coding, assist beginners in practicing thorough and describing coded work, and contribute to discussing best practices and standards in qualitative Research (Linneberg & Korsgaard, 2019). It also aimed at helping new researchers to understand the importance of coding decisions and properly document their work. It also contributes to conversations about standards and best practices for qualitative studies.

The participants' experiences were directly gathered and used as data in this study. Based on the interviews conducted, the data analysis followed specific steps: (1) Data Collection and Preparation: Participants, all of whom are licensed and practicing engineers, were interviewed about their experiences. Their responses were transcribed verbatim to ensure accuracy and authenticity. (2) Emic to Etic Transcription: After initial transcription, the data were analyzed from both the participants' perspective and the researcher's perspective, ensuring that interpretations were rooted in both individual experiences and broader theoretical frameworks. (3) Thematic Coding: Using a thematic analysis approach, responses were systematically coded. Categories and patterns were identified and refined as themes emerged from the data, focusing on engineers' decision-making, challenges faced, and their perceptions of best practices in their respective fields. (4) Cool to Warm Analysis: In this stage, the analysis moved from neutral or detached to more interpretive and engaged. This transition allowed for deeper reflection on how engineers' experiences influenced their professional practices. (5) Theme Identification: Finally, the themes and sub-themes were organized and visualized using a dendrogram tool. This helped to identify relationships between various themes, such as ethical considerations in engineering practice and collaborative decision-making in design and implementation.

Result



Figure 1. Opportunities and Challenges of Engineers on their roles in innovations

This phenomenological study showcases the lived experiences of engineers based in Qatar and the Philippines. It seeks to understand the engineers' lived experiences and perspectives as they navigate both the opportunities and challenges of their work in enhancing their fields. It is anchored in the central question, 'What characterizes the role of engineers in innovating and solving problems to enhance their fields?' This study also focuses on the specific question, 'How do the lived experiences of engineers highlight both the opportunities and challenges of their work in enhancing their fields?' Their lived experiences could reveal the choices that led to their staying as innovators in today's society.

Based on the responses from engineers in Qatar and the Philippines, three key elements shape their unspoken lived experiences depending on the three main themes, namely: (1) Career Progression – reflect the actual experiences of struggle or difficulty shared by the engineers—not just generic terms like "challenges" or "opportunities. (2) Work Adaptation – highlights further challenges, particularly in adjusting to new technologies, changing work environments, and evolving job expectations; and (3) Team Collaboration – emphasizes the opportunities available through working with diverse colleagues, fostering innovation, and solving complex problems together. Exploring these themes and their sub-themes offers deeper insight into the realities engineers navigate as they contribute to the advancement of their fields.

Figure 1 shows the simulacrum presenting the three major themes: Career Progression, Work Adaptation, and Team Collaboration. These themes represent key aspects of the engineers' lived experiences, illustrating how they navigate their careers, adapt to new challenges, and collaborate to enhance their work. Additionally, various sub-themes were identified within each theme: Skill Application, Goal Motivation, and Professional Transition under Career Progression; Task Organization, Plan Execution, and Challenge Resolution under Work Adaptation; and Workplace Cooperation, Mentorship Formation, and Technology Adaptation under Team Collaboration.

CAREER PROGRESSION

The first central theme discusses the real-life challenges engineers face in progressing through their careers. A career is defined as a job, role, or occupation a person undertakes throughout their life, often within specific fields or industries. Career progression, on the other hand, deals with the critical steps and challenges engineers take to grow and advance in their fields, often marked by professional uncertainty, competitive environments, and the need for strategic decision-making. The challenges associated with career progression include the navigation of transitions between job roles in different technical areas, how to maintain motivation while fulfilling duties, and where to perfectly apply the needed skills. Each one requires engineers to adapt to new responsibilities and environments. Engineers should manage personal and professional growth while adjusting to external factors such as technological advancements, changing industry demands, and organizational shifts. These transitions are not always smooth, as engineers often need to upskill, embrace new tools, and meet evolving expectations from employers and clients. Three sub-themes emerged from this significant theme: Skill Application, Goal Motivation, and Professional Transition.

A. Skill Application

The engineers' primary responsibility is to solve complicated issues and apply technical knowledge to practical settings. Applying engineering principles precisely, exercising critical thought, and continuously developing abilities to meet evolving industry norms are all necessary for this process. Given how quickly technology develops, precisely using one's skills is more important than ever. Though Engineers will most likely encounter challenges in their work, they see to it that they would quickly adapt so that they may be able to perform well and make the best possible choices with the new projects at hand, as stated by one participant:

“As an engineer, I am constantly adapting my skills to meet the challenges of new projects. It is not just about having the technical knowledge but about applying it effectively in real-world scenarios.” (P3)

Another participant highlighted that a different role in their current job may affect their ability to work. Applying their learned skills may also be critical and challenging should their current job not align with their original field of specialization, as stated by another of the participant:

“While I started as a mechanical engineer, my current role involves working across civil, electrical, and other engineering disciplines. My ability to

apply my core skills across different domains has been critical to my career progression.” (P5)

This response underscores that working across different fields in engineering is not solely about deepening expertise in one specific field, particularly in an industry that constantly evolves. For instance, one participant requires an ongoing commitment to learning and adapting to new challenges and technologies. .

“The knowledge I gained from general engineering sciences has been applicable in my career, helping me transition into my current role. However, success is not just about past studies; it requires continuous learning. Even though I now have extensive experience, I am still studying. I believe that no matter how much I know, there is always more to learn.” (P1)

Engineering is not simply about relying on past knowledge; it requires ongoing learning and the flexibility to adapt to new technologies and challenges. Another participant emphasizing that flexibility in applying one's skills is essential to meet varying demands:

“Engineering is about applying your skills in different ways depending on the challenges you face. Every project is different, and you have to think on your feet.” (P2)

This statement also emphasized the importance of flexibility when applying skills to meet the dynamic demands of the profession. Similarly, one participant emphasized that staying informed through continuous learning is essential, especially given the pace at which technology evolves in the industry:

“Continuing education is vital. In engineering, technology evolves rapidly. What worked five years ago might not work today, so we need to stay ahead.” (P7)

In Engineering continuous learning is essential to remain competitive in a field where technological advancements are constant and staying relevant in engineering means not only understanding current technologies but also anticipating and preparing for future innovations. For instance, one participant said engineers must also be mindful of the high stakes involved in their work.

“When you are designing a system or process, the stakes are high. Every decision you make has real-world consequences, so it is important to apply your skills with precision and care.” (P10)

This reflects the immense responsibility engineers carry, knowing that their decisions impact real-world systems and structures. Ultimately processes underscore the opportunities and challenges for engineers to progress within the field, encompassing their skill application.

B. Goal Motivation

Goal motivation is a driving force that propels engineers toward professional success, pushing them to achieve personal milestones, solve complex problems, and contribute meaningfully to their field. The drive to attain specific career objectives inspires them to innovate and make impactful contributions. Motivation stems from a blend of intrinsic and extrinsic factors, including personal ambition, the desire to leave a legacy, and the passion to solve real-world problems. As one engineer shared,

“I was inspired by my experiences working with engineers university. It was seeing their success that motivated me to carve my career path, knowing I could achieve similar accomplishments.” (P6)

This statement highlights the personal nature of goal motivation. Engineers often draw inspiration from mentors, peers, and role models whose success motivates them to set their individual goals. This personal drive serves as a force for growth and achievement, setting a benchmark for career development.

However, goal motivation is not solely driven by personal ambition; it is deeply rooted in the broader impact engineers wish to make on society. As one engineer noted,

“For me, engineering is not just about career progression. It is about knowing that what I am working on can have a lasting impact on the world, whether that is improving infrastructure, creating more sustainable solutions, or advancing technologies” (P8)

This perspective underscores that many engineers are motivated by the societal value of their work. They view their contributions as a means to address global challenges such as sustainability, infrastructure development, and technological advancement. The desire to create solutions that benefit society often fuels their dedication to continuous learning, innovation, and goal achievement.

A unique personal motivation is what makes this one participant to pursue engineering, linking their career to broader life ambitions;

"Sincerely, I only pursue it to realize my ambition of being a dancer.

Becoming an engineer is my dream job" (P3).

This participant's dual aspirations illustrate how personal and professional goals intersect and influence one's approach to engineering and life.

One participant highlighted the transition from academic architecture to professional practice, emphasizing the need for continuous learning and adaptation to advance one's career:

"There is a strong desire to advance your career. It would seem as though you had to learn more and give your all to your work, with little time for leisure or relaxation" (P4).

Despite strong desire, the resilience required to face challenges remains a central aspect of goal pursuit. Engineers must start from the scratch of their profession to grow with every challenge. One engineer shared,

"Each project is different, and every time I switch roles, it is like starting from scratch. But it motivates me because I know that I am gaining new experiences and growing with every challenge" (P2)

Engineers understand that each new project, role, or responsibility presents unique challenges. However, these obstacles also provide invaluable learning experiences that contribute to their growth, reinforcing those setbacks are not failures but development opportunities.

Sometimes, engineers are uncertain about whether or not they should stay and dedicate themselves to their careers or projects, and they could not find an answer themselves, so they turn to their family members and coworkers to help them on their decision on whether or not they should go on their path; as one engineer stated,

"So, make sure you are certain. Consult with your parents and colleagues. Most importantly, reflect on whether you truly want this path. If yes, you must dedicate yourself to the journey, which will likely take five to six years. It is a long commitment, and being resolute is essential" (P2).

Consulting with your parents and colleagues makes you more motivated. Mentors provide guidance, share insights, and help engineers set realistic expectations for their professional growth. As one engineer reflected,

"Mentorship was crucial for me. Seeing how senior engineers navigated their roles and how they set goals helped me realize the importance of planning and staying motivated through setbacks" (P7)

Through mentoring, engineers can improve their objectives and methods for accomplishing them by learning from the experiences of those who have successfully overcome comparable obstacles. This advice ensures that engineers stay motivated and focused as they strive toward their goals by helping them create a clearer professional vision.

This reflected in the engineers' ability to improve their skills and expand their knowledge base continually, one participant share their view,

"Rather than seeing this as a setback, I viewed it as an opportunity. It encouraged me to think, 'Oh, this is a great experience!' Through this role, I was able to enhance and expand my skills, not only in my specialization but also in other engineering disciplines" (P1)

This statement highlights the mindset shift that often accompanies goal motivation: Engineers see their challenges as opportunities for growth. By stepping out of their comfort zones and expanding their expertise, engineers can achieve higher goals for themselves, thus driving further innovation and excellence in their work.

Goal motivation is essential for improving the caliber of work engineers produce in advance professional and personal growth. As stated by one engineer,

"As an engineer, you have to be able to distinguish between right and incorrect as well as what kind of quality you should offer them in group and mentor them" (P5)

This statement reflects how engineers' drive to meet high standards motivates them to ensure the quality of their work while passing on their knowledge to others. Their motivation to maintain quality standards is not

about personal achievement but about contributing to the growth of their colleagues and the engineering field at large.

Finally, motivation challenges are part of the journey to professional fulfillment. Engineers must consistently evaluate their progress, overcome setbacks, and stay motivated despite challenges. One engineer shared,

“I would thus review all our work if I were you. Since that is my work, almost all of them have some characteristics. That is it, then. You build that knowledge, want to learn more, improve what you know, and use it in the design because you are practicing architecture” (P4)

This underscores that motivation often involves reflection and continuous learning—engineers must revisit their past work to gain insights and refine their approach, ensuring they remain on a path of constant improvement.

Engineers often navigate a landscape shaped by personal ambition and the desire to create a meaningful impact on society. Goal motivation emerges as a driving force that pushes them toward professional growth, innovation, and purposeful contribution. Inspired by mentors, peers, and role models, many engineers view success not only as a personal achievement but also as a benchmark for others in their field. Their motivation is rooted in a commitment to solving real-world problems—whether improving infrastructure, advancing sustainable practices, or contributing to technological progress. This highlights how goal motivation plays a crucial role in shaping engineers' paths and sustaining their drive to enhance both their careers and the broader society.

C. Professional Transition

As engineers progress in their careers, they frequently encounter critical moments that necessitate navigating transitions within their professional fields. These transitions encompass more than mere changes in job roles or industries; they involve significant shifts that require adapting to new responsibilities, acquiring new skills, and rethinking one's professional approach. Engineers, typically adept at solving technical problems, must often pivot and develop new competencies in leadership, project management, or even new sectors.

For instance, two engineers described the shift in career trajectory and the broader scope of responsibilities that came with it, emphasizing the necessity of acquiring an entirely new skill set alongside the flexibility and adaptiveness required in the field:

“As I mentioned before, I was a mechanical engineer by trade. Initially, I believed that obtaining my previous license would align my career strictly with mechanical engineering. However, the reality turned out to be quite different. I was a senior planning engineer, taking on responsibilities beyond mechanical engineering” (P1).

“When I moved from mechanical engineering to project management, I had to learn new skills and processes. The transition was challenging but enabled me to grow and gain a more holistic understanding of the industry.” (P3)

These examples highlighted engineers' struggles to improve their careers. While transitioning from a technical to a managerial position, engineers need to learn strategic thinking and manage groups, resources, and schedules. These abilities surpass the technical knowledge they learned in their first training.

The drive for career advancement or the pursuit of new challenges often motivates these professional shifts. For example, transitioning between sectors ranks as one of the most demanding changes since it requires engineers to adapt to new operational procedures, legal frameworks, and technical specifications. As three participants noted:

“Switching between industries has been one of the most significant challenges of my career. You need to learn the technical aspects and the regulatory and operational nuances of the new sector.” (P7)

“The shift from academic to professional life involves more than technical tasks; dealing with clients, other engineers, authorities, and unexpected challenges is crucial for professional success and securing new clients” (P4).

“On-the-job training facilitated the transition from school to work, reflecting a stark contrast between academic leniencies and the demanding nature of professional environments” (P10).

These statements underscore the versatility required of engineers to apply their core knowledge in varied contexts. It shows that professional transitions involve adapting to new external factors as much as acquiring new skills. The ability to adapt and apply one's knowledge in new contexts is an essential skill for professional growth, especially in transitioning between different workplaces. One engineer reflected on this by saying:

“Throughout my career, I have transitioned between industries, and each time, I had to apply my skills in ways that were specific to that industry's needs.” (P1)

Another critical aspect is the internal transformation engineers must undergo when moving into leadership roles. Transitioning from a technical to a managerial position often demands a mindset shift, as engineers must focus on managing people and leading teams rather than solely concentrating on technical execution. One participant shared their experience:

“It was difficult to go from a technical to a managerial position, but it helped me develop as a leader. I discovered that overseeing employees might be as difficult as resolving technical issues.” (P5)

This example illustrates how professional transitions involve developing leadership and interpersonal skills and acquiring new knowledge, which can significantly influence an engineer's career trajectory. Successful transitions hinge on the ability to adapt and embrace advancement. Another participant remarked:

“It is all about changing your attitude. It involves adapting to the environment you are now part of because it differs from the life you had while studying and the life you are now leading.” (P6)

This statement highlights the essence of adaptability and flexibility. Engineers assume new roles and responsibilities and are expected to utilize their technical competence and change their professional mentality.

Professional transitions are crucial to an engineer's career journey. They present challenges that compel engineers to develop new skill sets, adapt to different industries, and shift their focus from technical problem-solving to leadership and management. These transitions also offer significant growth opportunities, allowing engineers to expand their professional horizons and respond to the evolving demands of their industries. Whether through learning new technical aspects, embracing leadership roles, or navigating different sectors, engineers who effectively manage these transitions can achieve considerable career success and substantially contribute to their field. Three participants shared their views:

“I would like to recount my initial encounter in the field right after passing the board exam. My first assignment was in the Philippines, during which a tragic incident occurred where a foreman was fatally stabbed by one of my employees. As the project engineer, witnessing this was profoundly shocking” (P8).

“The real challenge begins after school, particularly with the daunting transition to becoming a professional engineer. The anxiety is not just about handling the job's pressure but also learning to manage expectations professionally, which starkly contrasts academic experiences” (P9).

“The journey in engineering starts fundamentally at school, where the basics are taught, providing all the necessary skills which one might choose to apply or further enhance in their professional life. This educational foundation simplifies the initial learning process, but truly dedicating oneself to engineering involves navigating its myriad practical challenges beyond academia” (P2).

These narratives portray engineers' trials and tribulations and how these experiences prepare them for future challenges. Many engineers acquire skills and abilities through experience, which continuously improves to meet future needs.

Professional transitions in the dynamic engineering field are pivotal moments that require engineers to adapt to new roles, responsibilities, and industries, broadening their skill sets beyond their initial technical training. As engineers progress from technical positions to management or switch between sectors, they face challenges that necessitate learning new operational and regulatory nuances and undergoing significant personal growth and mindset shifts toward strategic thinking and leadership.

Exploring Career Progression through the sub-themes of Skill Application, Goal Motivation, and Professional Transition provides a nuanced understanding of the challenges engineers face while striving to enhance their roles in the profession. As they navigate this intricate landscape, engineers demonstrate the adaptability and ambition necessary to shape their identities, improve their industries, and contribute meaningfully to technological and societal advancement.

WORK ADAPTATION

The second central theme highlights the engineers' adaptation to various obstacles they encounter within their workplaces due to the shifting demands of their profession. Work refers to an effort or activity that a person engages in regularly to earn a livelihood. Work Adaptation refers to the ability to adjust and respond effectively to changes, obstacles, or unexpected situations in the workplace. It captured the real-life challenges engineers faced as they organized complex tasks, executed detailed plans, and resolved unforeseen obstacles within dynamic project environments. As engineers progressed, their roles required greater flexibility, accountability, and responsiveness to new technologies, team structures, and client needs. This theme centered on how engineers confronted the realities of adapting to change while striving to maintain efficiency and precision in their work. These adaptive processes, though often difficult, remain vital for sustaining project success and professional relevance in a rapidly evolving industry. From this significant theme, three sub-themes emerged: Task Organization, Plan Execution, and Challenge Resolution.

A. Task Organization

Every engineer is pivotal in each project, with specific roles and tasks assigned to ensure efficient workflow and project success. The process demands proficient communication, teamwork, and collaboration to foster colleague cooperation. This principle extends beyond engineering to any workplace where clear task delegation is critical to prevent project issues.

Technological advancements have greatly enhanced task organization, workplace communication, and schedule management. They resulted in more efficient workflows and amplified their capacity for creative thinking, which are crucial for adapting to unfamiliar environments and overcoming obstacles; as three engineers mentioned,

“Previously, we managed schedules manually, but now, with tools like Microsoft Excel and Primavera, our primary tool, Oracle, can greatly create project schedules. This evolution has simplified our tasks and expanded our capacity to innovate, transforming us from traditional engineers into creative thinkers” (P1).

“With the advent of new tools like AutoCAD or project management software, I can now apply my skills in ways I never could before. The technology helps me be more effective in my work.” (P4)

“The establishment of a continuous improvement department allowed me to pioneer process and technique engineering at our company, enhancing operational efficiencies” (P6).

One engineer noted the potential for technology to democratize industries:

“Expanding autonomous systems like self-driving technologies should not be monopolized but rather made more accessible to foster innovation and prevent control by few large entities or governments” (P7).

These viewpoints highlight the need for engineers to adjust to changes in work situations and technological advancements constantly. Advanced equipment has made work easier and promoted a more flexible and cooperative workplace. These developments are essential for boosting engineers' professional development and enhancing their capacity to handle the complexity of modern-day engineering

environments. Engineers must remain adaptable and proactive learners to meet the demands of adjusting positions in their field.

The task organization is a fundamental aspect of engineers' responsibilities in ensuring the smooth operation of engineering projects. Each engineer plays a specific role, with clearly assigned tasks that support a structured and efficient workflow. Respondents emphasized the importance of effective communication, collaboration, and the strategic use of tools such as Microsoft Excel and Primavera to manage project schedules and streamline coordination. These technologies have not only simplified scheduling but also fostered innovative approaches to problem-solving. Engineers noted the value of a supportive work environment where team members adapt to evolving responsibilities, including increased engagement with clients and regulatory authorities. Task organization has become increasingly dynamic, driven by both technological advancements and the complex nature of project demands. To meet these expectations, engineers highlighted the necessity of continuous learning and flexibility, which enable them to navigate organizational challenges and contribute to more inclusive and adaptable practices within the industry.

B. Plan Execution

Plan Execution in engineering is vital for translating theoretical designs into tangible results. It requires precise task implementation, efficient resource allocation, and strict adherence to project timelines and protocols. This stage emphasizes sound decision-making, seamless coordination, and the ability to adapt when unexpected issues arise or ongoing adjustments are needed to maintain project momentum and effectiveness. One of the participants described this adaptive process by reflecting on their career path:

“Initially, I believed that obtaining my previous license would align my career strictly with mechanical engineering. However, the reality turned out to be quite different. I was a senior planning engineer, taking on responsibilities beyond mechanical engineering” (P1).

Further insights include the importance of valuing on-site experience over formal knowledge, as the same participant noted the significance of listening to construction workers:

“Some engineers think they are the greatest just by their profession; thus, they ignore the advice of their foreman or construction workers... If you work in the construction industry, you should pay attention to the men since they are good at what they do” (P1).

This finding highlights the issue of engineers who undervalue the experience of foremen and workers by underestimating their practical skills. It emphasizes that working in the construction industry depends on respect and teamwork between all job positions. On-site listening to veteran workers enables better choices along with more competent results.

Personal goals are intimately tied to professional tasks, significantly influencing innovative outcomes in engineering. The integration of individual interests with professional responsibilities can lead to enhanced dedication and creativity, as evidenced by the participant's experience:

“The integration of personal goals with professional tasks was exemplified by an engineer who aligned his interests with career objectives, enhancing his involvement in chemical engineering” (P6).

This alignment illustrates how personal passion can drive innovation. It enables engineers to apply their unique insights and enthusiasm directly to their work and fosters an environment conducive to innovation. Technological advancements fundamentally reshape engineering practices, particularly in information technology.

The introduction and enhancement of autonomous systems underscore the critical role of modern technology in engineering innovation, as mentioned by one participant:

“Technological advancements, especially in IT with the enhancement of autonomous systems, also play a crucial role in modern engineering practices” (P7).

This progression highlights how cutting-edge technologies create new opportunities for innovation and challenge engineers to continually adapt their skills and approaches to leverage these advancements effectively.

Lastly, adapting to managerial roles involves significant personal and professional growth, which is crucial for the practical application of innovative engineering plans. The shift from technical roles to managerial

positions often requires engineers to develop new skill sets, including leadership and strategic planning, as one participant stated:

“The challenge of adapting to managerial roles in project settings illustrates the personal and professional growth that occurs through real-life application of engineering plans” (P10).

To conclude, the transition into leadership and the capacity to manage complex engineering projects is crucial for fostering innovation. Participants emphasized that innovation in engineering is not limited to the development of new tools or technologies. Rather, it encompasses a comprehensive process that includes improving quality standards, aligning personal motivations with professional responsibilities, embracing technological advancements, and evolving into leadership roles. These insights illustrate that effective innovation is grounded not only in creativity but also in context, collaboration, and a commitment to lifelong learning. As one participant noted, engineering innovation is a continuous journey shaped by adaptability, strategic thinking, and the integration of diverse expertise.

C. Challenge Resolution

In engineering, problem-solving is fundamental not only to achieving goals but also to fostering personal development. The discussion participants emphasized the complexity of the challenges engineers face, ranging from interpersonal dynamics in the workplace to the personal goals that shape career decisions and professional growth. Their insights demonstrate how overcoming these obstacles enhances technical expertise while deepening self-awareness of strengths and aspirations. One participant pointed out a common challenge in the engineering field: the reluctance of some engineers to embrace the practical advice offered by experienced construction workers, which often hinders their ability to address real-world problems effectively.

“As you may be aware, not all engineers are successful. Therefore, that is one of the challenges. Some engineers think they are the greatest just by their profession; thus, they ignore the advice of their foreman or construction workers. They do not listen because they think they know everything and are engineers. If you work in the construction industry, you should pay attention to the men since they are good at what they do” (P1).

This perspective emphasizes the importance of humility and openness to learning from all project team members, not just those with formal engineering credentials. Cooperation between coworkers and listening to their suggestions ensures a greater understanding within oneself and the group and increases the chances for success.

Another participant discussed the typical career trajectory in engineering, noting that most start at entry-level positions and must work their way up through gaining experience and proving their value:

“Most engineers start at entry-level positions, and career growth takes time. If your parents are engineers in Doha, the Gulf, or anywhere else, they likely started their careers in lower-ranking positions in the Philippines. Engineering rarely begins at the top unless someone is exceptionally skilled or a genius. The reality is that around 95% of engineering graduates initially add little to an organization—just as most new employees do. That is why proving yourself and gaining experience is essential” (P2).

This statement underscores the gradual nature of professional development in engineering.

Other participants elaborated on how these challenges spur creativity and learning in engineering. The reflected influence of notable architects on their work and the motivational role of historical figures in their career, as mentioned by this participant:

“I, therefore, attempt to mimic his idea when I design. My father urged me to pursue a career in architecture. Tadawando and Frank Lloyd Wright were my main influences as an architect. You often strive to learn about the architects who came before you, particularly the well-known ones, and many things already in the industry” (P4).

This narrative showcases the inspirational and educational value of studying past masters in the field.

Setting high standards as a strategy for continuous improvement and goal achievement is one primary goal of engineers, as stated by one of the participants:

“My professional objectives are to set high standards for myself every year to provide me with more direction and to help me improve so that I can reach new objectives” (P9).

Meanwhile, another participant recalled the practical insights gained from on-the-job training, emphasizing the difference between theoretical knowledge and practical experience:

“That is just the way it is as a career. I developed a deep affection for the field. We had OJT when I was a student. Therefore, even though you know the beams, slabs, and designs you are studying in school, you will not understand them completely unless you see them. I therefore appreciated him during my OJT, even before I graduated” (P10).

These participants' insights highlight the complex interplay between personal development, professional challenges, and the continuous pursuit of knowledge in the engineering field. These challenges were seen as obstacles and vital elements that enhance skill, invoke creativity, and deepen professional engagement. This comprehensive view underlines the dynamic and evolving nature of engineering, where a blend of practical challenges, historical influences, and individual aspirations drives personal growth and innovation.

In conclusion, the work adaptation in engineering is beneficial to be able to adjust to a new environment and ways of working. Engineers need to keep learning to stay effective as their industries change. This theme shows how important it is for engineers to be flexible and open to new ideas to solve problems and improve their work.

TEAM COLLABORATION

The last major theme highlights the significant opportunities that arise from effective teamwork in engineering. A team is a group of individuals working together towards a common goal or purpose. Team collaboration focuses on creating opportunities and innovation, problem-solving, and professional growth. This theme explores how engineers leverage their skills and knowledge to collaborate, form strong relationships, and adapt to team dynamics to achieve their objectives. By working together, engineers pool their expertise to solve problems and achieve collective success. The lived experiences of engineers highlight the significant opportunities that teamwork brings to their work—especially in enhancing their fields. By fostering workplace cooperation, forming mentorships, and adapting to technological advancements, engineers create an environment where collaboration drives innovation and enhances their professional growth. Three sub-themes emerged from this significant theme: Workplace Cooperation, Mentorship Formation, and Technology Adaptation.

A. Workplace Cooperation

Workplace cooperation is crucial for achieving efficiency and effectiveness in engineering projects. It fosters an environment where engineers can discuss ideas collaboratively, schedule tasks, and solve problems, all while prioritizing open communication and teamwork. This collaborative aspect ensures that engineers can be productive and efficient in their roles, leveraging the strengths of each team member to contribute toward the success of the project. By working together, engineers can enhance their collective problem-solving abilities and drive the project forward with greater precision and effectiveness.

One participant emphasized the supportive dynamics within their team, which is critical for meeting client requirements through an interdisciplinary approach:

“I get much support from my coworkers. They are very supportive regardless of the deliverables we must produce or accomplish to meet the client's requirements because we have what you call an interdisciplinary review on our team. Thus, every team member's contribution is extremely valuable. We are experts in our field” (P8).

Adapting to team dynamics and collaborating with experts from other disciplines on which skills are needed to be applied to what is critical for optimal efficiency between coworkers working on the project. Two participants noted the importance of applying technical knowledge while working alongside others:

“When you are working with a team of people from different backgrounds, it is about knowing when to apply your skills and when to rely on others' expertise. Engineering is collaborative by nature.” (P6)

“In my role, I need to understand various aspects of engineering, not just my specialty. This means applying my knowledge across different domains to contribute effectively to team projects.” (P9)

The integration of new technologies is also a key factor in modern engineering practices, as one IT professional points out the potential for enhancing autonomous systems:

“As an IT professional, I believe the autonomous systems, for instance, could be enhanced. Are you familiar with autonomous systems? It is similar to autonomous systems, such as self-driving cars. Indeed, sir. Thus, autonomous systems include self-driving automobiles” (P7).

One respondent emphasized the urgency of a supportive work environment with cooperation between teammates for optimum performances:

“Understanding your team's strengths and weaknesses can create a supportive network that enhances everyone's performance” (P2).

Creativity and the opportunity for experimentation are further facilitated by supportive workplace environments, as one participant joyfully shares:

“I have regained my ability to be creative, thanks to the support from management. In emergencies, I am confident of their backing, plus they are financially supporting my projects, allowing me ample time to explore and enhance my creative skills” (P6).

Furthermore, collaboration in the workplace strengthens relationships and enhances networking, which is vital for career sustainability and fostering a sense of community in the engineering sector:

“In my opinion, the most crucial factor is working alongside knowledgeable colleagues and having access to tools that support both my personal growth and the development of my fellow engineers.” (P3).

In summary, practical workplace cooperation in engineering means blending various skills and technologies while fostering an environment that supports engineers' professional and personal growth. This collaborative approach fuels innovation and substantially benefits engineers and their organizations.

B. Mentorship Formation.

Mentorship Formation is key to professional advancement and knowledge sharing in engineering. Within this framework, a mentor and mentee often interact, creating a dynamic similar to that between a teacher and student. Such relationships promote a conducive learning environment and are vital for engineers as they enhance their skills and respond to society's changing needs.

For instance, one participant discusses the importance of decision-making within team settings, emphasizing the mentor's role in guiding these discussions:

“Thus, this is quite typical. You hold different views. You must decide; the team should determine the most effective strategy—the most effective way to deal with problems, worries, or showstoppers. Therefore, I mostly serve as our projects' technical lead or subject matter expert” (P7).

This highlights how mentorship can facilitate effective problem-solving and strategic planning within engineering projects.

Another participant illustrates the integration of technical and non-technical skills in their mentorship approach:

“My role's technical and non-technical facets, in my opinion, go hand in hand. As a manager, I lead by encouraging, advising, and letting my supervisors handle the fieldwork rather than micromanaging them. I can touch the non-technical side of things by managing people and sharing my knowledge or thoughts about technology” (P6).

This reflects the comprehensive nature of mentorship in engineering, where guidance spans beyond technical skills to include leadership and interpersonal dynamics.

The evolution of technology and its implications for training and practice in engineering are also addressed by participants who share their experiences and businesses;

“Today, there are many innovative ideas available for new engineers. In the past, engineers primarily relied on calculations, drawing skills, and

designing without the aid of technology. These advancements, however, significantly enhance an engineer's knowledge, particularly in design.” (P1).

This illustrates insights gained from their mentors:

“Engineers must be precise in their drawings and designs, especially in the 1980s and 1990s. However, AutoCAD was introduced in the early 2000s. Then, it was simple; you could design using AutoCAD even if you were not skilled at drawing. Creative concepts are needed to assist engineers who struggle to create designs using all those technologies” (P1).

This comment highlights how technology improvements contributed to an adjustment to the skills needed and how mentoring can help through these changes.

The participants discuss the real-world application of academic learning and the progression from academic research to real-life application, highlighting the crucial role of mentoring:

“Everything will be on paper or a computer when you are still learning, and it will largely be theories, designs, and sketches. However, everything you have been studying and sketching on paper will be constructed in real life when you begin working as an architect. Because real money will be involved and lives will be at stake, responsibility will follow. Real materials and real expenditures are involved” (P4).

This narrative highlights the mentor's role in preparing mentees for the realities of the engineering field, where theoretical knowledge must meet practical execution.

Lastly, the benefits of mentorship extend into networking and career advancement opportunities, as another participant note

“Networking and mentoring are the two components. Additionally, you will receive guidance from mentors in the same organization regarding what has to be done. Therefore, having a good mentor is quite beneficial. Networking comes in second. Therefore, as I just stated, this is crucial. Connecting with others in the same business is essential for engineers. Additionally, you must cooperate and establish a connection with them. Learn about them and their businesses; if they have similar connections to yours, you will have better future prospects. Learning from others is also enjoyable.” (P2).

In conclusion, mentorship formation in engineering is not merely about imparting technical knowledge; it is about building relationships that foster personal growth, professional development, and a deeper understanding of the field. Through mentorship, engineers gain the tools, insights, and networks necessary to tackle challenges and advance in their careers, all while contributing to the broader engineering community.

C. Technology Adaptation.

Adapting to new technologies and tools presents valuable opportunities in engineering. It serves as a powerful catalyst for boosting productivity, streamlining design processes, and addressing complex challenges with innovative solutions. Embracing technological advancements allows engineers to stay current, improve project outcomes, and contribute to more sustainable and impactful practices. This adaptability not only enhances individual effectiveness but also opens doors for broader contributions to society. One participant involved in project planning highlighted the transformative role of advanced simulation tools:

“We use Monte Carlo tools to analyze project delays in project planning. These tools provide valuable insights into project completion timelines based on the current delays, helping me make informed decisions on how and when a project can be completed. Monte Carlo simulations have benefitted my role” (P1).

This insight underscores how technological tools can enhance decision-making and strategic planning in engineering projects.

Moreover, another participant emphasizes the importance of proactive engagement and self-driven learning to keep up with technological advancements:

“It is ultimately up to you, but like anything else, you must be driven and engaged in what you want to do. You should connect with people, search inside your network, and seek articles. Use YouTube, readily available for brief descriptions, and read research articles. Many paid training courses are available” (P2).

This approach highlights the dynamic and self-directed nature of learning in modern engineering environments.

Technology supports engineers in their daily tasks and enables them to build connections and prepare for a sustainable future. A participant reflects on this continuous learning process, particularly relevant in the rapidly evolving IT sector:

“Goals. As I mentioned earlier, I became more driven to learn, increasing my knowledge as I gained experience at work. You must study, particularly in the IT industry, wherein technology changes quickly. It is an ongoing process of learning” (P7).

This story shows how maintaining skill and competitiveness requires a dedication to lifelong learning. Additionally, technology is essential in enhancing both technical and non-technical skills. In response to one engineer, becoming knowledgeable with software applications is just as important as improving one's ability to interact with people and solve problems:

“Technical refers to my ability to sketch and work with software such as AutoCAD and Lumion. Your technical skills include operating, drawing lines, and putting your thoughts on paper. My technological talents are those. Non-technical involves communicating with people, working with clients, and utilizing your brain to solve problems. The non-technical aspects are those” (P4).

This dual focus ensures that engineers are well-rounded professionals capable of tackling complex challenges.

The adaptability to new technologies is further emphasized by an engineer who continuously updates his skills to remain competitive:

“I have, therefore, equipped myself with the newest technologies, acquired new skills, and even participated in some training. To compete with other civil engineers both domestically and internationally. So, it is just a way of thinking. It simply refers to how you handle the difficulties posed by our day's rapidly evolving technologies and innovations” (P8).

This proactive approach is essential for personal growth and professional success in engineering.

Lastly, the integration of technology into education and practical training was highlighted by an engineer discussing the value of on-the-job training (OJT):

“Based on my experience, you should always expect the unexpected. You will experience things you never thought you would when you were studying. It is very different because what they teach in school is theoretical. You will not realize and appreciate what you have learned until you go on OJT. When you start OJT, you will see the value of everything you studied” (P10).

This perspective reinforces how real-world application bridges the gap between theoretical knowledge and practical expertise.

In conclusion, technology adaptation in engineering is crucial for enhancing productivity, solving design challenges, and fostering continuous professional development. Engineers must engage with new tools, participate in ongoing education, and apply their knowledge practically to stay relevant and effective in their fields. This commitment to technology and innovation drives individual careers forward and contributes to the broader goal of addressing global challenges through engineering solutions.

In summary, Career progression refers to how individuals advance in their professional lives. It includes *skill application*, where engineers use their existing skills to take on new challenges. *Goal Motivation* is crucial, as setting clear goals helps drive personal growth and commitment to their career. *Professional Transition* involves moving from one job to another, which requires flexibility and willingness to learn. Additionally, *Work Adaptation* is about how engineers adjust to their environment and responsibilities in their work. *Task Organization* is essential for prioritizing and managing their work effectively. *Plan Execution* involves carrying out strategies to complete tasks and achieve goals. *Challenge Resolution* focuses on solving problems as they arise and staying resilient. Lastly, *Team Collaboration* is about working together effectively in a group. *Workplace Cooperation* focuses on team members helping each other and sharing ideas to reach goals. *Mentorship Formation* involves experienced members guiding new ones to help them grow. *Technology Adaptation* in engineering is crucial for enhancing productivity, solving design challenges, and fostering continuous professional development.

Discussion.

Innovation in engineering contributes to technological advancement and is integral to addressing complex challenges that shape the future of societies and industries. This research delves into the innovation processes that engineers encounter, mainly through the nature of their work, which are often as critical as the technical aspects themselves. Exploring these dynamics shows how innovation influences not only the final outcomes but also the core practices and decisions that guide in engineering work.

Participants in this study have shared personal anecdotes that illustrate the multifaceted nature of innovation in their daily work lives. These stories reflect various experiences, from the challenges and emotional responses to the profound societal contributions made through innovative solutions. Through these narratives, it becomes apparent that a constant interplay between advantages and challenges marks the lived experience of engineers in innovation.

The participants highlighted being adaptable as an important skill. Professionals in the rapidly changing fields of engineering and technology must constantly adapt their methods, techniques, and approaches to problem-solving. This flexibility is essential for being practical and relevant in a field where antiquated methods can suddenly become redundant or inefficient. Engineers often have to change paths and accept new techniques or tools, a challenging but rewarding process necessary for professional and personal development.

Another significant aspect of innovation in engineering highlighted by the participants is the goal motivation that comes with the territory. Engineers often grapple with decisions that have far-reaching consequences, necessitating a deep understanding of their work's technical and moral implications. The goal motivation of engineering innovation drives progress, fosters creativity, and inspires engineers to solve complex problems and improve society. Participants noted that navigating these goals requires a strong moral compass and a collaborative approach to decision-making, where diverse perspectives can help illuminate the best paths forward.

Moreover, the emotional responses associated with innovative engineering work are profound. Engineers may experience various emotions, from the high of breakthrough success to the stress and frustration of technical setbacks. This field's emotional landscape is complex and demands resilience and emotional intelligence, qualities that engineers must develop alongside their technical skills.

Engineering innovation's societal contributions are perhaps its most significant aspect. Engineering projects often have the potential to impact communities and ecosystems, improve quality of life, and solve critical problems. Participants expressed a strong sense of purpose and fulfillment in contributing to these larger goals, underscoring the role of engineers as key players in societal development.

CAREER PROGRESSION.

Career progression in the engineering field is not a straight path. It's a process filled with evolving challenges that test both the technical and personal development of engineers. Moving forward in this profession takes more than expertise—it requires resilience, adaptability, and a clear sense of direction. Engineers must constantly refine their abilities while navigating the emotional, societal, and institutional barriers that shape their careers.

While more women have entered the engineering field in recent decades, the journey toward equity continues to be marked by challenges. Women have gained ground through greater representation, access to opportunities, and recognition via loans, publications, and awards (Charlesworth & Banaji, 2019). This shift is helping to change the outdated image of engineering as a male-only profession. Still, barriers related to nationality, socioeconomic background, and access to resources persist—limiting career progression for many (Wanelik et al., 2020). These disparities underscore the need for policies and practices that go beyond diversity statistics and work toward meaningful inclusion (Ekakoro, 2023).

Skill application one of the major hurdles engineers face is applying their skills in real-world settings. This challenge goes beyond simply knowing how something works—it involves using that knowledge to solve problems, meet goals, and innovate under pressure. Engineers are expected to perform with both accuracy and creativity, especially in new areas such as prompt engineering, where technical and artistic skills merge to create AI-generated text-to-image art. This integration of skill and innovation highlights how engineering is constantly evolving (Oppenlaender et al., 2024). Yet, staying up to date with emerging tools and practices demands continuous learning and often presents high pressure to perform, especially in competitive or unfamiliar environments.

Goal Motivation, another key challenge is staying motivated throughout the ups and downs of an engineering career. Motivation helps engineers stay focused, overcome obstacles, and find purpose in their work. However, sustaining this motivation isn't always easy. Personal doubts, academic pressures, and unclear goals can lead to burnout and disengagement. Research shows that shifting beliefs about personal capabilities, as well as the emotional struggles students and professionals experience, significantly affect performance and career decisions (Robinson et al., 2019; O'Hara et al., 2021). Unfortunately, many engineering programs don't fully address these emotional aspects. The lack of tools to cultivate empathy and emotional awareness in engineering education makes it harder to train professionals who can collaborate effectively and support one another (Walther et al., 2017).

Professional transition often involves transitions—whether it's changing roles, entering new industries, or exploring emerging fields. These shifts can be difficult, especially when certain paths are undervalued. For instance, engineers pursuing Engineering Education Research (EER) often face skepticism from peers who may see it as less technical or rewarding (Dart et al., 2021). Despite strong employment prospects in engineering compared to fields like the arts or social sciences, job search strategies and transition experiences can vary greatly. Moving from school to work, or from one specialty to another, involves both logistical and emotional hurdles (Somerville & Scholarios, 2021). The ability to adapt is essential, yet it's not always supported by institutional structures or peer understanding.

In conclusion, career progression in engineering is shaped by how well individuals face challenges—whether they involve applying skills in high-stakes situations, staying motivated through difficult periods, or navigating transitions and systemic inequities. As the profession continues to evolve, creating a culture that embraces emotional intelligence, inclusivity, and adaptability will be essential. Engineers aren't just solving technical problems; they're learning to grow through personal and professional challenges—making them not just better professionals, but stronger individuals.

WORK ADAPTATION

Work adaptability is a vital characteristic of engineers who need to deal with the challenges posed by rapidly changing technology, new project requirements, and dynamic advances within their respective industries. Effectively allowing for adaptation to these changes is laden with severe challenges. The engineer is forced by these competitive and efficient times to continuously adapt and introduce tools and techniques such as generative artificial intelligence into their work. AI, especially conversational bots, offers possibilities for advancing an engineer's practice through simulating real-world conditions and giving immediate feedback. While promising, the challenge lies in seamlessly integrating those tools into their work while retaining the highest level of effectiveness and creativity, with engineers at the helm of putting everything into practice (Qadir, 2023).

Challenge resolution is an important characteristic of engineering work. The term accorded the overcoming of obstacles encountered in every aspect of the profession, from personal life to project management. All the time, engineers meet unforeseen challenges, whether technical setbacks, project delays, or limitations on resources. Effectively overcoming these challenges requires some problem-solving skills that cannot stem only from technical expertise. This brings all technical knowledge together with leadership skills to confront these challenges with multidisciplinary engineering management and move the project along (Htet et al., 2023).

An example, in safety management, would be these two approaches to ensure protocol conformity—somewhat like each other—on one end managing adaptability through systems oriented towards safety rigidly, while the other has centralized control wherein flexibility is key (Provan et al., 2020). Both the approaches truly have their own sets of challenges— in emergencies, directed adaptability then becomes an obstacle to flexibility, while in cases where decisions ought to be made very fast, centralized control actually impedes it. Therefore, engineers subjecting themselves to the variable nature of the challenges have to configure the strategies.

Plan execution is an important area in ensuring successful engineering project closure, fraught with challenges. Engineers first create a plan for their work and then adapt it when unexpected delays, technical setbacks, or shift in priorities occur. The plan would lose its coherence in the event of a sudden breakdown if these unanticipated distractions are not placed into consideration. The project-maintaining its momentum through proactive solutions and real-time adjustments.

Effective engineering management is a synthesis of teamwork, risk management, resource allocation, and project planning. Therein lies the main problem: how to put it all together. Engineers have to quickly

make decisions based on data for optimal resource allocation, risk management, and scheduling upfronts no matter what surprises crop up (Onyenagubo, 2024). This is where a marriage of technical rail identification along with leadership and strategic thinking becomes a point of utter necessity. *Task organization* is another key challenge facing engineers, especially in an environment characterized by tight deadlines and the simultaneous juggling of multiple tasks. In order to successfully achieve any project goal, engineers must prioritize tasks, perform effective workflow structuration and ensure that all team members have been clearly aligned with their responsibilities. Concurrently handling these tasks has never been an easy thing to do, especially with the growing complexity of modern-day projects.

Task organization goes beyond having just great time-management skills. Measures taken along the road include evaluating ongoing tasks and changing work approaches per new demands along the way. Among the more difficult questions are when to delegate responsibility for particular tasks, what tools to implement for greatest efficiency, and how to communicate effectively with all of the stakeholders in a project. For smooth workflow and improved productivity, the role of project management tools and frameworks cannot be overemphasized. However, the challenge lies in carefully selecting the specific tool or methodology that addresses each project's unique requirements, which may highly influence task completion success (Barao et al., 2017).

Work adaptation is vital for engineers but comes with different challenges within challenge resolution, plan execution, and task organization. Engineers face unexpected challenges, adjust plans in real time, and organize their tasks in ways that maximize productivity and effectiveness. Task-solving challenges, execution under pressure, and task organization are key qualities that are required to address these challenges. The continuing realignment of industries and complexity advancement in projects require engineers to consistently develop their skill in adaptation and overcoming challenges, which, therefore, includes their own development and successful delivery of a project.

TEAM COLLABORATION

Team collaboration is essential for engineers because it fosters innovative solutions, enhances problem-solving abilities, and contributes to the successful completion of projects. This study highlights the advantages of understanding how global software engineering teams coordinate through meetings and collaborative platforms (Stray & Moe, 2020). Effective teamwork enhances communication, accountability, and the integration of diverse perspectives, ultimately increasing efficiency and leading to higher-quality project outcomes. By utilizing meetings and collaborative platforms, engineers can work seamlessly across different roles, leveraging the unique skills and viewpoints of their team members.

Workplace cooperation is equally crucial in engineering, as it enables individuals to collaborate through open communication, trust, and mutual support to achieve shared goals. This collaboration enhances both efficiency and job satisfaction. In the context of engineering, it aligns with behavior engineering and workplace communication, which go beyond summarizing study results to offer practical solutions that contribute to transformative company culture (Ewuzie & Obong, 2024). Cooperation is essential, especially when addressing real-life engineering challenges, and workplace environments should encourage the exchange of ideas and respect among diverse team members.

Mentorship formation plays a pivotal role in the professional development of engineers. It not only allows them to expand their knowledge but also aids in their ongoing growth as professionals. In software engineering education, mentorship programs often involve teams of undergraduate students working together to design software systems under the guidance of professional engineers (Iacob & Faimly, 2020). These programs foster a bond between mentors and mentees, creating a teacher-student relationship that promotes open communication, constructive feedback, and continuous learning.

Furthermore, *technology adaptation* is crucial for engineering professionals, enabling them to stay informed about new developments that improve efficiency and lead to innovative solutions. According to Bongomin et al. (2020), the twenty-first century has seen significant advancements through the discovery of new technologies that have transformed the way we live and work. These innovations have improved our connectivity and access to information, reshaping how we interact with our environment, communicate, and perform tasks. To thrive in this fast-evolving landscape, both individuals and organizations must embrace innovation and quickly adapt to changing technological environments.

Conclusion.

This research has explored the critical aspects of career progression, work adaptation, and team collaboration in the context of engineers' lived experiences. Engineers' career trajectories shape their

ability to navigate complex professional environments, and the application of skills, goal motivation, and successful career transitions strongly influence their development. On the other hand, new roles and responsibilities present challenges and opportunities, requiring engineers to adapt to them while continuously developing their competencies.

The ability to resolve challenges, execute plans effectively, and organize tasks efficiently is crucial for their success. The capacity for engineers to navigate unexpected issues and maintain project momentum while Plan Execution ensures that strategies are translated into actionable steps, driving project completion. Effective Task Organization underpins engineers' ability to manage multiple competing priorities, optimizing their workflow and improving productivity.

Another essential component of engineering professional development is team collaboration. The capacity to adjust to new technologies improves the effectiveness of teamwork by allowing engineers to use the latest tools and collaborate with different teams. Additionally, mentoring formation is essential for knowledge transfer and skill development, as seasoned engineers help their peers overcome technical obstacles and advance their careers.

Ultimately, the issues this study examined—career advancement, work adaptation, and teamwork—are intricately linked and critical to engineers' ongoing development throughout their careers. The ability to adapt, work together, and use knowledge in meaningful ways will continue to be essential for attaining success on an individual and organizational level as the engineering sector develops. Ensuring their ability to prosper in a world that is changing and becoming more complicated. We advance our knowledge of the engineering profession by emphasizing how important these themes are for individual growth and influencing the larger engineering setting.

Establishing work environments that promote cooperation, coaching, and flexibility is essential as companies continue to develop and adopt new technology. It guarantees that engineers are prepared to take on new problems. Professionals with strong technical abilities and the capacity to collaborate well with others and handle their business's changing needs will be essential to the future of engineering.

A course to becoming an engineer begins with rigorous educational training, which prepares individuals with crucial technical understanding. An adventure that combines the technical, professional, and personal challenges and rewards of the career, regardless of intellectual stimulation, the complexity of the work may be overwhelming; engineers are frequently tasked with solving issues that have excessive stakes, whether it is ensuring the safety of structures, creating software program that is secure, or developing technologies with societal influences. The consistent pressure for perfection can also affect their mentality, especially in high-tech sectors. Hard work can occasionally pressure engineers to overwork. Engineering is an inescapable part of the career, and we are increasingly more aware that their selections could have profound implications on society, the surroundings, and individuals. For engineers, their paintings are not always just about technical achievement.

However, they are contributing to the more excellent desirable. In fields consisting of sustainable strength, environmental engineering, or healthcare generation, engineers often express a profound experience of fulfillment. The field still faces challenges, and individuals from diverse backgrounds often encounter gender bias, racial discrimination, and pressure to prove themselves. The push for diversity and inclusion within corporations and academic institutions has created more opportunities for mentorship, career advancement, and networking.

Professionals in engineering should use flexible strategies to support career growth, teamwork, and continuous learning. Joining mentorship programs, handling cross-functional tasks, and seeking leadership roles help build soft skills and strategic thinking. Flexible learning methods, such as quick learning, certifications, and hands-on practice, allow engineers to stay updated without affecting their daily work. At the team level, promoting openness to ideas, using communication tools, and encouraging collaboration to improve how engineers work together. A supportive and shared learning culture helps teams grow and solve problems effectively. Additionally, encouraging ongoing feedback and knowledge sharing within teams further strengthens collaboration and drives innovation. Engineers who embrace diverse perspectives and continuously seek personal and professional development contribute to a more dynamic and successful engineering field.

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