

The First Steps Matter: Early Career Influences on Women Engineers' Success in Sri Lanka

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Abstract: Despite growing numbers of women entering engineering education, their representation in senior leadership remains limited. As a part of a still ongoing research, this study aims to investigate how early professional encounters shaped identity, resilience and career strategies of women engineers who ultimately ascended to top-tier roles in their professional lives. Purposefully selected nine women engineers in top management positions in Sri Lankan industrial sector were interviewed face-to-face to collect data at present. Voice-recorded interviews were transcribed verbatim and analyzed following inductive thematic analysis method with the support of NVivo software. Thematic analysis revealed five emerging dominant patterns: early career isolation and gender-based challenges, navigation of cultural expectations, adaptation through education and credentialing, critical role of mentors and peer networks, and formation of leadership identity. Participants described being the sole woman in their departments, facing skepticism regarding their technical abilities and managing work-family tensions. Yet, through proactive upskilling, family and peer support and resilience, they converted these challenges into stepping stones for advancement. While data collection and analysis are not yet complete, the themes identified so far provide important early insights into the global discourse on gender in engineering, emphasizing the importance of early-stage interventions, structural support systems and mentorship programs.

Keywords: Career Experience, Early Career Success, Gender and Engineering, Women Engineers in Sri Lanka

1. Introduction

Globally, women remain underrepresented in engineering, particularly in leadership roles. This underrepresentation is not merely a matter of numbers but is reflective of systemic barriers rooted in gender bias, institutional inertia, and socio-cultural norms. In South Asia, these challenges are often magnified by rigid gender roles and limited institutional support for work-life integration. In Sri Lanka, although women's enrolment in engineering programs has seen a steady rise over the last two decades, this has not translated proportionally into leadership roles in the profession [1], [2].

Globally, research has shown that early career experiences play a pivotal role in shaping identity, resilience, and leadership capacity among women engineers [3]. Early encounters with bias, isolation, or supportive mentorship often determine not only retention but also the trajectory of leadership development [4]. Yet, within the South Asian context, and Sri Lanka in particular, there is limited scholarly exploration of how these formative experiences influence long-term professional outcomes. Most studies remain descriptive, focusing on

participation rates rather than lived career narratives.

Although prior studies in Sri Lanka have acknowledged gender disparities in engineering [5], they have not systematically examined the micro-level processes through which early career experiences translate into leadership trajectories. The knowledge gap lies in the absence of inductive, narrative-based evidence that connects women's early professional struggles and adaptive strategies with their later success in leadership and influence.

The aim of this study is to explore the early career experiences of leading women engineers in Sri Lanka and analyze how these shaped their identity, resilience, and career strategies, ultimately contributing to their professional

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progression based on an ongoing data collection process.

The significance of this ongoing investigation lies in three domains. First, it contributes to academic scholarship by extending emerging thematic analyses of women's careers into the South Asian engineering context. Second, it seeks the attention of policy-makers, employers, and educational institutions to design interventions that support women's career advancement. Third, by amplifying the voices of successful women engineers, it creates role models and narratives that can inspire the next generation of professionals in Sri Lanka and beyond.

2. Literature Review

In various countries and cultures, the under representation of women in engineering and other areas of science, technology, engineering and mathematics (STEM) is widespread. This distinction is often attributed to systemic barriers, social expectations and gender biases in the educational system, workplace environment and broader cultural contexts [6]. The literature reveals that these challenges begin as early as childhood and extend into higher education and professional settings.

2.1 Women in Engineering: Global Perspectives

Worldwide, women are historically under-represented in engineering. Research by [7] indicates that this lack of representation stems not only from social prejudices, but also from the lack of role models and mentors in this field. Similarly, [8] argues that the workplace environment often lacks adequate support for women engineers, which contributes to high unemployment rates.

Studies in countries like India and China indicate that cultural and structural factors significantly influence women's participation in engineering. For instance, while many women may doubt their technical abilities, organizational policies often fail to address their specific needs [9]. These findings are consistent with the experience of women engineers in Sri Lanka who face similar sociocultural challenges [1].

2.2 The Role of Mentorship and Leadership

The importance of mentoring for the development of women engineers' careers is a recurring theme in literature. It emphasizes that

mentorship programs can help women overcome workplace challenges by providing guidance, encouragement and advocacy [10]. In areas dominated by men, especially for women, there are often no informal support networks. In addition, it should be noted that mentoring positively affects job satisfaction and career development, underlining its role in retaining women in STEM careers [11].

Leadership qualities of women engineers are also the focus of research. Women in the engineering leadership role exhibit higher empathy and resilience, qualities that are essential to foster inclusive work cultures [12]. This is consistent with the findings of Benschop and Verloo [13], which highlight how women leaders often act as catalysts for change, to address systemic inefficiency and to improve the dynamics of the workplace.

2.3 Gender-Based Challenges in the Workplace

Gender-based bias and discrimination remain a major obstacle to women in engineering. Studies [14] and [15] show that women often face open and concealed gender-based challenges, including limited resources, exclusion from critical decision-making processes and harassment. These challenges are exacerbated in resource limited environments where women often have to assume additional responsibilities to prove their competence. Literature also emphasizes the impact of social perceptions on women's careers [16] and points out that traditional gender roles often place women's expectations excessively and force them to balance their professional and personal responsibilities. This double burden may impede their career growth, especially in demanding fields such as engineering.

2.4 Women Engineers in Sri Lanka

Studies in Sri Lanka provide valuable insight into the unique challenges and opportunities faced by women engineers. Although in recent years women have entered engineering, the workplace environment remains predominantly male-dominated [1], [17]. This highlights that social norms and expectations often discourage women from pursuing a long-term engineering career despite their qualifications and capabilities. In Sri Lanka, the role of mentorship and institutional support is also evident. The research emphasizes the need for targeted interventions such as mentoring programmes and gender sensitive policies to support engineers in their early careers. These

conclusions highlight the importance of creating inclusive workplaces that recognize and address the unique challenges faced by women in engineering.

Despite growing awareness, few studies have explored the lived experiences of women who have overcome these barriers. Literature from other developing contexts, such as Asian countries, suggests that early exposure to role models, targeted educational interventions, and institutional policies supportive of gender equity can play a pivotal role in changing outcomes [18]–[20]. However, such frameworks are under-researched in the Sri Lankan context. This study fills that gap by investigating how women navigated early professional environments, where gendered obstacles were most pronounced and how these experiences shaped their leadership trajectories. Our findings build on previous research by illustrating how Sri Lankan women engineers not only resisted marginalization but also developed adaptive strategies, including leveraging education, support systems and resilience, to transform early adversity into long-term professional achievement. These narratives highlight the potential of contextually grounded policies and institutional interventions to shift the trajectory for future generations of female engineers.

3. Methodology

This study is part of an ongoing large-scale qualitative research that investigates the career success of Sri Lankan women engineers. As part of that research, this paper aims to explore how the early career experiences of Sri Lankan women engineers, those who later assumed leadership roles, shaped their professional identity and trajectory. Given the study's aim to explore the complex and context-specific experiences of women in engineering, a qualitative research approach was deemed most appropriate. This methodology enables the capture of rich, nuanced insights into participants' lived experiences, perspectives, and meaning-making processes, insights that are often inaccessible through quantitative methods focused primarily on numerical measurement and analysis [21]. Face-to-face interviews were chosen as the data collection method, as they are widely employed in qualitative research to facilitate the exploration of participants' experiences through direct, in-depth engagement [22].

Using a purposive sampling strategy, data were collected from nine participants representing diverse engineering sectors, including academia, public works, manufacturing, and energy, to ensure the findings reflect a range of professional contexts [23]. Purposive sampling was adopted in this study to recruit women engineers whose career trajectories could provide rich insights into how early experiences shaped long-term professional outcomes. The selection focused on individuals with over ten years of professional practice, recognized membership in IESL or equivalent bodies, and experience in senior technical or leadership roles. This approach was chosen not for statistical representativeness but for the depth and relevance of narratives, making it particularly suitable for an ongoing project where additional participants may be included as data collection continues. By deliberately seeking information-rich cases, the study ensured that the voices captured would meaningfully illustrate the links between early career encounters, resilience, and eventual leadership identity [21].

Nine senior female engineers with more than ten years of professional experience shared the reflections of their career paths. Semi-structured interviews were conducted in 60–90 minutes to promote open dialogue and capture nuanced perspectives [22]. These interviews were recorded with the consent of the participants and converted verbatim into Microsoft Word files for analysis to achieve the objectives of the study.

Inductive Thematic Analysis (ITA), as outlined by [24], was employed to identify recurring patterns and key themes within the interview transcripts, allowing insights to emerge organically without being influenced by the predominant findings of the literature review. ITA was chosen for this study because it offers a flexible yet rigorous framework particularly suited for an ongoing research project. As additional interviews are integrated, this approach allows themes to be refined, expanded, or consolidated in response to emerging narratives, ensuring that the analysis evolves with the data rather than imposing rigid categories prematurely. Its systematic process maintains transparency and credibility while capturing both recurring patterns across participants and unique experiences that may surface as the study progresses. Importantly, thematic analysis facilitates the connection of individual stories to broader cultural and



institutional contexts, enabling the findings to generate insights that are both grounded in lived experience and relevant for shaping policy and practice in engineering education and workforce development.

This analysis followed the six phases of ITA outlined by [24], adapted to the ongoing nature of the study. First, the authors engaged in familiarization with the data by repeatedly reading the interview transcripts and noting initial ideas. Second, systematic coding was conducted using NVivo software, allowing meaningful segments of text related to early career experiences, challenges, and strategies to be highlighted. Third, the codes were collated into potential themes, which involved clustering related codes into broader categories that reflected recurring patterns across participants. Fourth, the emerging themes were reviewed and refined by checking them against both the coded extracts and the full dataset to ensure they accurately represented participant experiences. Fifth, the themes were defined and named to capture their essence in a concise yet meaningful way, ensuring clarity and distinctiveness between themes. Finally, the results were written up by weaving together participant excerpts and analytic commentary, thereby grounding the themes in lived experiences while also linking them to broader scholarly debates.

This stepwise process enhanced the rigor and transparency of the analysis while ensuring that the findings remained deeply rooted in the voices of women engineers. Since ethical considerations were central to the study, informed consent was obtained from all participants before the interviews. Confidentiality was ensured through anonymity while voluntary participation was emphasized to uphold participants' rights [23].

To improve the trustworthiness of research, triangulation was used to cross-check the results in narratives, members were vetted to validate interpretations with participants and rich and thick descriptions were provided to facilitate transferability [23]. Although the small sample size and the retrospective nature of the study present limitations, this methodology is consistent with established qualitative research practices and provides valuable information on the early career experience of Sri Lankan women engineers.

4. Results & Discussion

The interviewees came from a variety of engineering fields, including Electrical, Materials, Textile, Civil, Chemical and Electronics Engineering. Each has over 10 years of relevant industrial experience. All of them serve/served in top management positions as leaders in their firms. Further data collection may cover the missing areas to generate a generalizable result at the end of the main project.

ITA revealed five emerging dominant patterns: early career isolation and gender-based challenges, navigation of cultural expectations, adaptation through education and credentialing, the critical role of mentors and peer networks and the formation of leadership identity. Further data collection will enable authors to refine and extend the findings, which may lead to additional or redefined themes. Participants described being the sole woman in their departments, facing skepticism regarding their technical abilities and managing work-family tensions as early insights of this study. Yet, through proactive upskilling, familial and peer support and resilience, they converted these challenges into stepping stones for advancement.

The following sections describe the above emerging findings in detail.

4.1 Early Career Isolation and Gender-Based Challenges

In alignment with Faulkner's conceptualization of "gender-in/visibility" in engineering spaces [3], participants reported a pronounced sense of isolation during early career stages. Participant B stated, *"I was the only female engineer in the division,"* and described discomfort during night operations and assumptions about her ability to manage fieldwork. Participant D noted, *"Only I was female in the District,"* reflecting both professional and geographic solitude. Participant J added, *"There were no girls [in my department],"* highlighting the rarity of female presence in some technical environments.

Participant A echoed this sense of isolation from her university years: *"I was exempted from survey camp because I was the only girl in the batch. That felt like a loss in learning."* This early segregation had implications on her confidence in practical engineering applications. Similarly, Participant G reflected on being in hazardous

Table 1 - Demographic Information of Participants

Participants	Years of Professional Experience	Current Employment Status	Educational Qualifications	Field of Work
A	15	Employed Full-Time	BSc. Eng Hons	Electrical Engineering
B	18	Entrepreneur	BSc. Eng Hons, PGDM & PQHRM (Japan - AOTS)	Materials Engineering
C	29	Employed Full-Time	PhD, MPhil, BSc.Eng Hons	Textile Engineering
D	37	Retired	PhD, C.Eng, BSc.Eng Hons	Civil Engineering
E	30	Employed Full-Time	BSc.Eng Hons / MBA	Electronic & Telecommunication Engineering
F	30	Employed Full-Time	C.Eng, BSc.Eng Hons	Chemical Engineering
G	30	Employed Full-Time	BSc.Eng Hons	Civil Engineering
H	11	Employed Full-Time	BSc.Eng Hons, MBA	Electrical Engineering
J	19	Entrepreneur	BSc.Eng Hons, CIMA	Electrical Engineering

environments alone: *"I had to excuse myself from chemical-based site visits during pregnancy. But before that, it was just me, even in remote industrial zones."*

These experiences resonate with the concept of symbolic marginalization, where women are present but not fully integrated into workplace culture [4]. Participant F emphasized that early in her career, male colleagues were prioritized for international training: *"They selected a male engineer to send to Europe for the training, and he resigned later. I ended up managing the entire project without any prior support."*

In addition to physical isolation, several participants described psychological distancing. Participant H recalled: *"Coming from a girls' school, I was too shy to even speak in meetings at the beginning. I always sat at the back and kept quiet."* This aligns with findings by [25], who note that women's initial hesitancy often stems from a lack of gender-representative mentors and a sense of not belonging.

Despite such challenges, many participants reframed disadvantages as growth opportunities. Participant B remarked, *"We want to convert challenges into opportunities,"* and used her status as the only woman to differentiate herself positively. Participant E similarly reported: *"In the training, some seniors tried to put me in the corner, but I remembered the*

advice: don't let anyone put you like a flower. I made sure to stand up and speak out."

These narratives collectively illustrate that early isolation, though challenging, often became the foundation for resilience, independence, and a strong sense of professional identity, qualities that later propelled these women into leadership. The necessity to navigate alone shaped their confidence, visibility and credibility in the male-dominated engineering landscape, reinforcing the "prove-it-again" phenomenon described by [26].

4.2 Navigating Cultural Expectations and Family Dynamics

Navigating cultural expectations emerged as a nuanced and often emotionally complex process for participants. Many described balancing deeply entrenched social norms about femininity, marriage and caregiving with professional aspirations. These dynamics often created internal tensions and external barriers that impacted early career decisions and role negotiations.

Participant C, who worked in a factory environment, recounted, *"My baby was underweight due to chemical exposure... I resigned,"* revealing the sacrifice required when institutional support for maternity safety was lacking. Her decision underscores observation of Ceci et al. [27] that work-family conflicts



frequently derail women's STEM careers in the absence of structural accommodations.

In contrast, others benefited from supportive family networks. Participant H noted, *"My husband said, 'You go and complete your MSc,'"* and cared for their young child while she pursued postgraduate education abroad. This dynamic support allowed her to sustain career momentum, illustrating the transformative power of shared caregiving responsibilities, a factor echoed in the findings of [28].

Participant G shared, *"When I was pregnant, I was excused from radioactive and chemical industry visits,"* but only after making the request herself, suggesting an environment where gender-sensitive accommodations were not standardized. Similarly, Participant D reflected on the absence of institutional adjustments but noted, *"I had to go to the field even at night. But my husband and family supported me, so I could do it."*

Other participants faced opposition rooted in cultural conservatism. Participant H recalled, *"My mother cried the whole night when I got selected to a far university. She didn't want me to live far from home,"* illustrating how geographic mobility was contested, even for educational advancement. Participant J added, *"I was not selected for some jobs. I don't know if it was because I wasn't attractive or interesting,"* touching on appearance-based judgments that influence women's employment outcomes.

Despite such challenges, participants who persisted found that their cultural negotiations laid the groundwork for vital life skills. As Participant E put it, *"I live with my parents and my son. My family understands my travel needs and helps me balance everything."* This suggests that navigating expectations built relational management and adaptability, skills later leveraged in leadership.

These accounts align with [1], who emphasizes that Sri Lankan women often depend on informal support structures in lieu of institutional resources. The findings also resonate with intersectional lens of [29], highlighting how gender, marital status and cultural setting intersect to create unique constraints and opportunities for women in engineering.

Ultimately, cultural expectations did not solely act as barriers but also as formative conditions

shaping the participants' professional ethos, leadership capacity and ability to operate within complex socio-professional ecosystems.

4.3 Adaptation Through Education and Credentialing

Education and professional credentialing emerged as a strategic response employed by nearly all participants to counteract institutionalized gender bias and assert professional legitimacy. This theme reflects the broader discourse in engineering literature, where women are often seen to engage in what [25] call "hyper-credentialing" - the pursuit of multiple qualifications to offset perceived deficits in authority or credibility.

Several participants described how upskilling became both a survival tactic and an aspirational goal. Participant B explicitly stated, *"I completed CCNA, CIMA, CIM, and an MBA,"* aligning her career trajectory to include both technical and managerial expertise. Her multi-pronged education allowed her to transition from core engineering to broader strategic roles. Participant F noted similarly, *"I was not only an Engineer but also a Manager,"* reflecting a conscious expansion of her identity to encompass leadership beyond technical confines.

Participant A, who pursued graduate studies abroad, said, *"My foreign training gave me broader perspectives... it shaped how I lead now,"* signalling that international exposure not only built technical capacity but also instilled leadership confidence and global awareness. Likewise, Participant E emphasized, *"Toastmasters helped me build confidence in communication... it changed my voice,"* highlighting the importance of soft-skill development in parallel with technical growth.

In some cases, additional learning filled institutional gaps. Participant C, after leaving her factory position due to health risks, pursued a consultancy path and noted, *"I read a lot on self-development and psychology. I wanted to guide others better."* This underscores that for many women, professional learning was self-driven, multidimensional and integrated with personal growth.

These experiences support argument [29] that women in engineering often undertake supplementary efforts to build their legitimacy and visibility [30]. This theme also reflects [23]

view that women must “over-perform” to earn equal recognition [4].

The long-term impact of this strategic adaptation was clear: participants were not only able to transition into diverse sectors but also ascend to leadership. Their additional qualifications created career mobility, expanded networks, and positioned them as versatile professionals, traits that enhanced both resilience and promotability in an otherwise rigid hierarchical system.

4.4 Role of Mentors and Peer Networks

Mentorship and peer networks emerged as foundational mechanisms of resilience, growth and leadership development across participants’ early career trajectories. For many, the presence of mentors, whether formal or informal, helped offset the isolation and self-doubt engendered by male-dominated environments. These relationships often filled gaps left by institutions that lacked structured support for female professionals.

Participant E recounted pivotal advice from a senior manager during training: *“They will try to put you in a flower pot... Don’t let that happen to you.”* This metaphor was emblematic of the kind of subtle sidelining many women face early in their careers and the advice served as a turning point that shaped her assertiveness in future roles. Participant B echoed the importance of support: *“One of my friends pushed me to apply to (name of the current workplace). I hadn’t even considered it. That changed my entire career path.”*

Others found empowerment through structured peer engagement. Participant H stated, *“Until I joined Toastmasters, I didn’t have the confidence to speak. Now, I even lead sessions,”* emphasizing how peer-led platforms cultivated public speaking and leadership capabilities. This finding aligns with the assertion that early peer mentorship can significantly enhance women’s self-efficacy in technical disciplines [10].

Social belonging and trust were also vital. Participant D described her time in the field: *“There were female draftsmen of my age... they were always with me even in the night,”* illustrating how solidarity among peers mitigated the challenges of being the only woman in remote or difficult postings. Similarly, Participant J noted, *“My university friends are still my strongest network. We share job leads, advice, and*

motivation,” suggesting that networks formed during early career phases can have lasting professional utility.

Interestingly, several participants identified a lack of senior female mentors as a persistent barrier. Participant C observed, *“There was no one like me at the top. I had to imagine the path,”* pointing to the absence of relatable role models in leadership. This mirrors findings from [26], who argue that visibility of female role models is key to sustaining women’s ambition in STEM.

Overall, mentorship and peer relationships did not only act as buffers against early exclusion, they served as accelerators for career growth, confidence-building and identity formation. These social ecosystems, often cultivated through professional associations, extracurricular groups or informal friendships, were instrumental in helping women navigate hierarchical and sometimes exclusionary work environments.

4.5 Career Progression and Leadership Identity

The progression from early-career experiences to leadership identity was not linear for the participants, it was shaped by an iterative process of challenge, reflection, adaptation and validation. The data clearly demonstrated that early adversity was not merely endured but actively leveraged as a learning ground that cultivated managerial competence, strategic vision and empathetic leadership.

Several participants articulated how professional recognition came only after consistent high performance. Participant J shared, *“They advertised later saying, we want more like me,”* referring to a shift in perception at her workplace once her sustained efforts in a male-dominated sales-engineering domain bore fruit. Initially denied access to international training opportunities, she later became the head of the lighting department and subsequently a business owner. Her trajectory reflects the ‘prove-it-again’ bias described by [31], wherein women must continually demonstrate competence to be acknowledged.

Participant E noted, *“I was given two warehouses to manage... I had no prior experience, but they said, you’re the best person,”* highlighting how taking on high-stakes responsibilities early developed her leadership capacity. Similarly, Participant B recalled, *“We visited more than 40 industries... it gave me confidence to advise national*

agencies." This breadth of exposure strengthened her domain authority and positioned her for national-level consultancy.

The women's career stories also reflected self-directed career crafting, where they proactively shaped their roles and responsibilities. Participant G described this progression: *"I handled all the supportive subjects. That's why I was able to grow up quickly."* Her involvement in handling supportive subjects, which combined both technical and business aspects, proved pivotal in her advancement to department head and later as a business founder.

These findings are aligned with recent leadership studies of [32], [33] that emphasize the importance of early career narratives in constructing resilient leadership identities. The women in this study emerged not only as capable professionals but as leaders who subtly transformed their organizations through inclusive practices, empathy and structural awareness.

Participant H, who transitioned from a shy recruit to an institutional leader, summarized this transformation: *"I didn't get the Chief Engineer post, but I was the youngest shortlisted. That means something is changing."* Her story captures how early marginalization catalyzed both personal growth and systemic reflection.

In summary, the seeds of leadership were sown in the crucible of early challenges, where participants navigated exclusion, developed confidence, acquired diverse skills and gradually gained visibility. These early career experiences were not incidental but instrumental in shaping their eventual leadership identity and influence.

4.6 Implications for Policy and Practice

The preliminary insights of this study have significant eye-opening implications for engineering education providers, industry stakeholders and policymakers aiming to promote gender equity in Sri Lanka's engineering workforce. Based on this study, following recommendations can be made.

4.6.1 Engineering education institutions

Early Mentorship Initiatives:

Institutions should implement mentorship connecting undergraduates with female professionals to normalize women's presence in leadership.

Leadership Skill Building:

Communication, negotiation, and decision-making workshops can be embedded into engineering curricula to empower female students.

Gender Sensitivity Training:

Faculty and administrative staff must be trained to identify and address gender biases in academic practices, such as lab assignments, field placements, or selection for opportunities.

4.6.2 For employers in engineering sectors

Structured Onboarding for Women:

Establish formal induction processes that pair early-career women engineers with mentors, particularly in male-dominated subfields.

Promotion of Flexible Work Policies:

Employers should support maternity leave, return-to-work schemes and flexible schedules to accommodate caregiving responsibilities.

Visibility of Role Models:

Companies should actively promote success stories of female engineers and ensure their representation in leadership development programs.

4.6.3 Professional bodies and policymakers

Inclusive Policy Frameworks:

Regulatory bodies like IESL can introduce guidelines that mandate gender-balanced hiring panels, grievance redressal mechanisms and family-friendly benefits.

Support for Re-entry and Continuing Education:

Government and industry collaborations could fund programs for women returning to engineering after career breaks.

National Recognition of Women Engineers:

Annual awards, fellowships or spotlights can enhance visibility and create aspirational figures for younger generations.

These interventions should not be isolated efforts but part of a comprehensive national strategy to ensure that women in engineering are not only recruited but retained, supported, and advanced equitably throughout their careers.

4.7 Limitations and Future Research

While this ongoing study provides preliminary insights into the early career experiences of leading women engineers in Sri Lanka, several

limitations must be acknowledged. First, the participant pool was composed exclusively of women who had successfully progressed into senior roles. This introduces a selection bias that overlooks the experiences of women who left the profession or were unable to advance, which may present different or more acute challenges.

Second, the qualitative nature and sample size, though rich in depth, limit the generalizability of findings. The goal was not statistical representation but thematic saturation; however, broader surveys or mixed-methods approaches could offer complementary insights.

Third, while the study captured a limited diversity of engineering fields and institutions, it may not fully account for regional, ethnic or socioeconomic variation within the country. Ongoing data collection aims to include women from underrepresented engineering fields, regions or lower-income backgrounds to explore the compounded effects of intersectionality.

Lastly, the retrospective nature of the interviews may be influenced by selective memory or post hoc rationalization. Future phases of the study could incorporate longitudinal tracking of early-career women to provide more dynamic insights into evolving barriers and adaptive strategies.

Additionally, subsequent research could examine organizational practices more systematically, comparing companies with high female retention and advancement to those with persistent gender gaps, and consider cross-country comparisons within South Asia to identify cultural and policy factors that shape women's engineering careers.

5. Conclusions

Early career experiences are not merely phases of professional entry but are foundational in shaping long-term identity, confidence, and leadership potential among women engineers. This ongoing study provides compelling evidence that the interplay of early isolation, gender bias, cultural expectations, and proactive adaptation deeply influence women's trajectories in engineering. Participants who faced marginalization, whether through being the sole woman in a department, denied opportunities, or navigating cultural restrictions, demonstrated a

remarkable ability to transform barriers into stepping stones as early insights of this study. They sought additional education, built informal networks and relied on both peer and family support to establish professional legitimacy. These formative experiences became crucibles for cultivating leadership, resilience and strategic foresight.

Conceptually, these findings enhance understanding of how gendered early career experiences shape professional identity and leadership development. Practically, organizations can implement mentorship programs, inclusive policies, and visible role models to support early career women. Socially, addressing systemic biases advances gender equity and recognizes women's contributions in engineering.

Preliminary insights from this ongoing study suggest that systemic change must begin at the early career stage. Institutional support, equitable policies, and visible role models can accelerate inclusion in engineering leadership. While further data collection may refine these observations, the emerging value lies in informing local and international stakeholders on fostering environments where talent, not gender, determines professional success.

Given the study's ongoing nature, current findings focus on women who reached senior roles, potentially overlooking those who faced greater barriers. Future phases aim to include participants from diverse regions, socioeconomic backgrounds, and engineering fields, incorporate longitudinal tracking, examine organizational practices, and enable cross-country comparisons in South Asia, providing actionable insights for inclusive engineering careers globally.

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