Bridging Gender Barriers: The Working Environment, Challenges, and Leadership Opportunities for Women Civil Engineers

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Abstract

Nepal's highly embedded patriarchal ethos has consistently presented engineering, and in particular, civil engineering, as predominantly a male field. This masculine perception has led to structural impediments in keeping women from full participation in the profession. Despite these challenges, Nepali women are increasingly breaking these social barriers and making significant contributions to the field of civil engineering.

This study examines issues of women engaged in the civil engineering career in the Department of Roads in Nepal. addressing the impact of gender stereotypical prejudices, conflict between work and life, and a shortage of opportunities for mentoring. Qualitative and quantitative analysis techniques are employed to report significant barriers and explore how women can better occupy leadership roles. By advocating organizational reforms and supportive policies, this paper also seeks to contribute to establishing a gender-sensitive and equitable workplace for women in the civil engineering profession at the Department of Roads.

*(***Key Words:** *Gender Equality, Disproportionate Gender Distribution, Glass Ceiling, Masculine Norms, Gender Disparity, Gender Sensitization, Policy Reform, Structural-Cultural Barrier, Institutional Mentorship Structure, Career Progression Framework)*

A. INTRODUCTION

The Constitution of Nepal, 2015 mandates at least 33% women representation in the federal and provincial parliaments and 40% representation in local governments, reflecting the nation's commitment to gender equality in decision-making bodies. In support of this, the Civil Service Act (Amendment, 2007) has earmarked 45% of competitive vacant posts for underrepresented groups, of which 33% are earmarked for women. As of 2025, women constitute approximately 29% of the civil service workforce, indicating gradual progress toward inclusive public administration[1].

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[1]*Women's presence in civil service reaches 29 percent over 17 years.* (n.d.). *MyRepublica.* Retrieved November 11, 2025, from https://myrepublica.nagariknetwork.com/news/womens-presence-in-civil-service-reaches-29-percent-over-17-years-33-74.html

However, the lack of women in civil engineering remains a long-standing global problem, linked to the profession's historically male-dominated tradition. Despite policy-level changes and greater awareness of gender parity, women continue to encounter structural obstacles to joining, becoming successful, and advancing within the profession. This study identifies the challenges faced by women civil engineers—particularly in Nepal—and offers pragmatic solutions towards building a more welcoming, inclusive, and encouraging professional culture.

1. Objectives of the Study

The general purpose of this study is to analyze gender barriers in the work environment, the problem, and the opportunities of female leaders in civil engineering working at the Department of Roads in Nepal. The specific objectives are:

- To analyze organizational culture and working environment for women civil engineers.
- To assess the problem encountered by women at the level of civil engineers.
- To explore career development and leadership opportunities available to women civil engineers.

2. Literature Review

The engineering career has long been stereotyped in a patriarchal way, highlighting the male-skewed complexion of the profession. This is evident in civil and construction engineering fields, where women with identical qualifications are relegated to clerical or supportive roles rather than significant technical ones (Faulkner, 2007; Powell *et al.,* 2009). Trends here point towards how masculinity in the profession is paired with technical competence and leadership capacity.

Cockburn (1991) and Fletcher (1999) illustrate how gendered occupational segregation in engineering gives women "soft" occupations—such as planning or communication—while decision-making and on-site work are left for men. Such segregation not only reinforces workplace stereotypes but also limits women's access to information technology and leadership positions.

3. Regional and International Insights

a) Sri Lankan Experience

Menezes (2018), in her article titled "Of Struggles, Truces and Persistence: Everyday Experiences of Women Engineers in Sri Lanka," published in the Journal of International Women's Studies, analyzes the mundane experiences of women engineers in male-dominated institutions. Applying feminist organizational theory and intersectionality, Menezes identifies how women engineers constantly negotiate legitimacy in the field and bureaucratic roles. Her research identifies the "emotional labour" women must undergo to prove themselves, often putting in extra time and effort compared to their male colleagues to be heard.

b) Women in Nepal's Transport Sector

A recent World Bank report (2024), *Bridging the Gap: Female Labour Force Participation in Nepal's Transport Sector*, finds that women comprise only 6% of the technical staff at the Department of Roads (DoR). In large-scale infrastructure projects—such as the Nagdhunga–Naubise–Mugling corridor—fewer than 5% of women are included, even if equal pay conditions are met. Cultural constraints, long-distance travel, the use of heavy machinary and the need to reside in labour camps are cited as major discouragements for women joining field-based employment. The underrepresentation persists despite programs such as Strategic Road Connectivity and Trade Improvement Project (SRCTIP) and Bridge Improvement Maintenance Program (BIMP II), which aim to improve gender inclusion through targeted training and employment.

c) Workplace Culture and Gender Norms

Work environments for engineers tend to have a "macho" culture rooted in long working hours, requests for perpetual full-time physical attendance, and after-work socialization, which remians unfriendly towards women (Watts, 2009). The individuals who do not conform are sometimes silently judged or excluded from informal professional networks. These work environments result in professional alienation and gender hierarchies in civil engineering organizations.

d) Gender Bias, Stereotyping, and Leadership

Sustained gender stereotypes remain an obstacle to women's credibility as leaders in technical domains. According to Galsnjigmed and Sekiguchi (2023), descriptive and prescriptive biases deem women less agentic and sanction women assertive in leadership, leading to a systematic "lack of fit" with perceived leadership norms. The biases also exclude women from making decisions.

e) Work-Life Balance and Caregiving Responsibilities

One of the structural issues is the work-life conflict that disproportionately affects women. Fuhrmans and Dagher (2024) point out how family caregiving duties, especially in South Asian family arrangements, contradict professional requirements of civil engineering and result in attrition and lower promotion rates for women within their careers.

f) The Mentorship Gap in Engineering

Lack of mentorship is among the most prominent obstacles in women's retention and career progression in engineering. Lamola, Pooe, and Munongo (2024) highlight how the deficiency in female role models makes it difficult for young women to envision themselves occupied in technical or leadership roles. Their work highlights the need for formal mentorship in fighting turnover and promoting inclusion within civil engineering.

B. RESEARCH GAPS, JUSTIFICATION AND METHODOLOGY

a) Research Gaps:

While a range of studies identifies the role of gender norms, work-life balance, and cultural expectations for women in civil engineering, little is empirically known regarding how professional networks and mentorship shape women's career progress in road construction firms, particularly in developing countries like Nepal.

Specifically, current studies lack the following areas:

- Cross-country comparative perspectives on gender and engineering.
- Distinction between formal and informal mentorship.
- Intersectional identities (e.g., caste, class, marital status) in building professional access.
- Intersection of personal narratives or first-hand testimony, relying primarily on institutional documents.

b) Research Questions

Based on the identified gaps, the study builds the following research questions:

- How does the career advancement of female civil engineers in road infrastructure projects in developing nations get built through mentorship and networking opportunities?
- How are the mentorship experiences of women posted in field jobs versus administrative/supportive jobs?
- In how many ways do organizational or cultural norms in road construction limit women's access to informal professional networks?
- How do intersectional identities (e.g., gender, age, caste, marital status) influence the quality and availability of mentorship to women engineers?

c) Research Methodology

i. Research Design

This study employed a quantitative descriptive study design with qualitative insights using open-ended questions. The general aim was to assess the working environment, difficulties, and leadership opportunities as experienced by women civil engineers working at the Department of Roads (DoR), Nepal. A mixed-methods design was employed for capturing a number of trends alongside individual narratives.

- Quantitative Component: A structured questionnaire was used to ascertain women engineers' knowledge about work culture, issues, and career growth.

- Qualitative Component: Open-ended questions and interview process were used to obtain deeper insights into organizational and lived experiences' dynamics from the self-perspective of the individuals.

ii. Population and Sampling

The study population was all female civil engineers employed in the Department of Roads, Nepal. At the time of the study, there were 77 female engineers in the DoR. The purposive sampling technique was applied to select women respondents who were employed in civil engineering roles at different organizational levels.

20 questionnaires were returned, providing a 26% response rate. While the sample is limited, the data is helpful as the first indication of the gender dynamics of the workplace. Interpretation of the findings is cautionary, noting the restriction caused by potential non-response bias and the low generalizability of the study.

iii. Data Collection

The primary instrument of data collection was a standardized questionnaire, designed to elicit factual data and subjective experience. The instrument had three sections:

- Section I: Working environment and organizational culture.
- Section II: Gender difficulties and experiences working in engineering roles.
- Section III: Career opportunities for development and leadership.

Most of the questions were closed-ended, employing Likert-scale and multiple-choice items to facilitate statistical analysis. A few open-ended questions were interspersed to enable qualitative remarks and contextual reflections from the participants.

iv. Data Collection Procedure

Data collection was conducted through a hybrid approach, with the use of online surveys and hardcopy questionnaires for on-site use. The respondents were informed about the study's purpose and guaranteed confidentiality and advised that their contribution was voluntary. Informed consent was obtained prior to completion of the survey. The response was anonymized so that the participant’s identity could not be traced.

v. Data Analysis

- Quantitative data were analyzed using Microsoft Excel and SPSS. The information was interpreted with the help of descriptive statistics such as frequency distributions, percentage analysis, and cross-tabulations.
- Qualitative data from open-ended questions were analyzed using thematic analysis. This allowed for the coding of recurring patterns linked to gender bias, mentorship, leadership pathways, and suggestions for workplace adaptation.

vi. Ethical Considerations

The study adhered to ethical research procedures. All participants provided informed consent, and their confidentiality and anonymity were ensured. The data were utilized only for scholarly and research purposes, and no personal information was collected or disclosed during the process of the research exercise.

C. RESULT AND DISCUSSION

a. Representation of Engineering Services in the Public Sector

It has been observed that 9.95% of the total services being distributed by Public Service Commission Nepal (PSC) is the comparatively smaller share of technical professionals in the civil service of Nepal. Some 55% of them are selected through open competition, and 45% are distributed by the national-level policy of reservation, to promote social inclusion and to compensate for historical disadvantages. (Source: Public Service Commission Nepal, 2082)

Table 1. National-Level Reservation Policy Distribution (within 45%)

Group	Reservation (%)
Women	33
Indigenous People	27
Madhesi	22
Dalits	9
Persons with Disabilities	5
Backward & Rural Areas	4

Source: *Public Service Commission, 2082*

The reservation policy operates to check structural imbalances in recruitment through the grant of 33% reserved posts to women, the highest for any cluster. This constitutes institutional recognition of gender disparities, especially in male-stream technical areas such as engineering.

However, as the employment and recruitment figures show, intentions in policy at the planning level have not yet materialized into equal representation in the real world.

b. Growth of Engineering Services (Five-Year Trend)

Table 2. Recruitment in Nepal Engineering Service (FY 2076/77–2080/81)

Fiscal Year	Number of Engineers Recruited
2076/77	23,381
2077/78	23,202
2078/79	23,870
2079/80	24,309
2080/81	25,152

Source: Department of National Personnel Records, 2080/81

PSC's engineering staff grew by 9.3% over five consecutive years, echoing wider opportunities in public physical infrastructure and other technical disciplines. That increase does not seem to have translated into gender balance, especially in fields like road construction, which remain male-dominated.

c. Gender Balance of Civil Engineers in Nepal

As per the statistics of the Nepal Engineering Council (2082), the total number of registered civil engineers remains 41,258, out of which male civil engineers are 36,988 and female civil engineers are 4,270, i.e., 10.35%.

Despite all endeavours made toward increasing education and employment among women, women engineers make up only 10.35% of the profession. Such severe underrepresentation suggests deep-rooted gender stereotypes presuming a connection between engineering—specifically civil and field-based engineering work—and masculinity as well as physical endurance. Such attitudes often deter women from pursuing or continuing in engineering careers, especially within public sector building-related institutions like the Department of Roads (DoR).

d. Gender Representation in the Department of Roads (DoR)

Table 3. Current Workforce by Position in DoR – Engineering Service, Civil Group, Highway Subgroup

Position	Recruitment Quota	Currently Working	Male	Male	Female	Women Office Heads
Superintendent Engineer (Class I)	25	25	25	25	0	0
Sr. Divisional Engineer (Class II)	135	130	113	113	17	6

Engineer (Class III)	440	406	346	346	60	0
Total	600	562	484	484	77	6

Source: Department of Roads, Administration Section, 2082

The DoR has 562(93.67%) staff on record, indicating that the hiring is nearing completion. However, women occupy only 13.7% of the total posts filled (77 out of 562) as women. The statistics indicate that there is a vacuum in leadership since no woman is an Ist Class Gazetted Officer, there are only 6 women (4.6%) designated as office heads among SDEs (IInd Class Gazetted Officer), and 17.3% occupy the position of an engineer (IIIrd Class Gazette Officer).

Despite the implementation of reserved quotas and inclusionary measures, the statistics indicate a highly skewed gender imbalance in the Department of Roads. Women engineers remain far below national norms, with lower visibility in senior and leadership positions. Even though women have achieved mid-grade officer ranks (II and III Class), women remain excluded from top-level positions, which denotes the presence of a glass ceiling. Low female representation has conformed to overall findings from literature on how engineering fields (specifically construction) entail a masculine culture—long field exposure, physical endurance, and assertive command—further alienating women from streams of leadership (Watts, 2009).

e. Results and Discussion (Opinion Survey)

A questionnaire was purposively distributed among female engineers of the Department of Roads through online survey software. The sample comprised 4 Senior Divisional Engineers and 16 Engineers, selected from a total of 77 women engineers. Of them, 20 respondents were included in the survey. The results are categorized into three thematic categories in relation to the goals of the study: (1) Working Environment and Organizational Culture, (2) Challenges Faced by Women Civil Engineers, and (3) Career Development and Opportunities for Leadership.

f. Working Environment and Organizational Culture

- **Demographics:** The respondents to the tune of 30% were between 25–30 years of age, 75% were Brahmin, 75% were married, and 80% had a master's degree. Most of them (60%) were in joint families, and 80% of them were Gazetted Third Class Officers.
- **Organizational Culture:** Women's representation in the engineering staff in DoR is still low, standing at only 7.3% at the Engineer level and none at the Superintendent Engineer level (DoR, 2082). Representation in decision-making is also poor: only 5% of the respondents believed that the decision environment was very inclusive, while 45% believed it was not very inclusive or not inclusive at all.

Only 10% reported the existence of formal mentorship schemes, while 60% reported that there were no such support programs. Regarding work-life balance, 50% reported that there were no organizational policies, while only 30% reported the existence of flexible work-hour policies in their organizations. This is consistent with international literature highlighting the institutional support role in facilitating women's participation (Fuhrmans & Dagher, 2024).

- **Gender Bias in Workplace Culture:** A high percentage of respondents (25%) reported regular gender bias, while 45% reported occasional bias. The majority (70%) had witnessed or heard of gender-based harassment or discrimination. These results are consistent with wider cultural trends identified in Watts (2009), where "macho" workplace cultures pervade engineering disciplines, making workplaces hostile for women.

g. Issues Confronted by Women Civil Engineers

- **Field Access Barriers and Inclusion Issues:** Field access barriers and inclusion issues remain a serious problem. Although 20% had frequent issues, 35% had them occasionally. Most importantly, 45% were sometimes or are usually excluded from important projects.
- **Family and Social Expectations:** Family and social expectations emerged as significant hindrances, according to the respondents. Sixty per cent said that cultural expectations define their profession. Additionally, 60% reported that family responsibilities had moderate to significant impacts on their work lives.
- **Gender Stereotypes and Imposter Syndrome:** More than half (55%) frequently faced gender stereotyping, and another 25% experienced it occasionally. Similarly, 55% reported frequently experiencing imposter syndrome, aligning with the research by Galsnjigmed and Sekiguchi (2023), who describe how internalized gender roles affect women's confidence in leadership.
- **Networking and Mentorship:** Limited networking opportunities and poor mentorship were the key hindrances identified. While 60% reported some degree of difficulty with networking, 45% noted the lack of mentorship. This is in line with findings by Lamola et. al. (2024), which identify mentorship as crucial for career development and retention.
- **Work-Life Balance:** Work-life conflict remained a major concern. While only 15% reported constant issues, 65% reported occasional problems. These findings also attest to the global evidence that caregiving roles remained disproportionately assigned (Fuhrmans & Dagher, 2024).

h. Career Progress and Leadership Opportunities

- **Promotion and Reward:** Only 20% of the women civil engineers replied that they frequently got promotion and reward based on merit, while 35% replied that

they were neither promoted nor rewarded. Gender bias and transparency issues were brought out as core barriers. This accords with Fletcher's (1999) view that women are overlooked even when they work well.

- **Access to Leadership Roles:** Leadership remained a man's world: 5% had accessed leadership roles, 35% had not tried to access them, and another 35% reported limited support. The barriers were gender bias (45%), family responsibilities (20%), and lack of mentorship (10%).
- **Training and Development:** Only 10% of women had access to training programs. As much as 40% were unaware that such programs existed. Similarly, policies at the workplace were ineffective (35%) or unknown (40%).
- **Networking and Visibility:** While 90% of the respondents wished to be leaders, only 30% observed women in visible leadership roles. The majority (60%) felt that men enjoy more casual networking opportunities. Such findings justify intentional visibility and representation strategies.
- **Promotion Criteria Transparency:** Surprisingly, 75% felt promotion criteria were transparent, despite qualitative feedback suggesting that such criteria may not have been applied in the same manner to men and women in reality.

7. Conclusion

This study presents the fact that despite modern policy frameworks such as reservation quotas and inclusion requirements, entrenched gender disparities still exist within Nepal's Department of Roads—a large platform for the civil engineering profession—under the guise of a nominally gender-balanced public service. Women hold few senior positions and are faced with systemic barriers linked to gender prejudice, limited mentorship, and work–life imbalance. These challenges discourage not only their career progression but also the real accomplishment of gender equality in public administration.

The findings underscore the need for more targeted, gender-responsive interventions. Key recommendations include the implementation of inclusive field deployment and safety policies, structured mentorship programs, gender sensitization training, and clear career progression pathways. Addressing these institutional and cultural barriers is essential to creating an enabling environment that supports the full and equitable participation of women in civil engineering.

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