



Bridging the Gap: A Construction Management Perspective on Women's Role in Addressing Labor Shortages in the Philippine Construction Industry

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Abstract

The Philippine construction industry, a critical driver of national growth, continues to face persistent labor shortages, particularly in skilled trades where only 10.8% of the workforce is classified as skilled. Despite women comprising 13% of those certified in construction-related technical training, their actual participation in the workforce remains disproportionately low. This study investigates women's potential contributions to workforce sustainability from a construction management perspective. A quantitative descriptive-correlational design was employed, using structured surveys administered to 148 professionals in the National Capital Region. Stratified purposive sampling ensured representation across project managers, engineers, HR officers, government officials, and training institution representatives. Data were analyzed through frequency distribution, mean scores, and paired sample t-tests to assess perceptions and efficiency outcomes. Findings revealed strong recognition of women's capacity for technical, supervisory, and site-based tasks, with respondents noting their positive impact on productivity, efficiency, teamwork, and safety compliance. Women outperformed men in safety, time management, attendance, and collaboration, while showing comparable results in productivity and quality. However, barriers such as discrimination, stereotypes, and limited access to training were consistently identified, reducing workforce availability and project success. Results confirm that women remain an underutilized resource in construction management. Their inclusion strengthens collaboration, safety, and efficiency, aligning with Lean Construction principles and HRM strategies. Construction management should adopt inclusive workforce planning, competency-based training, and gender-responsive policies to optimize women's participation, thereby enhancing efficiency, sustainability, and long-term industry stability.

Keywords: women in construction, skilled labor, labor shortage, construction management, gender inclusivity, workforce inclusivity



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INTRODUCTION

The construction industry is a primary catalyst for economic growth in the Philippines, yet it faces a critical bottleneck in labor availability. While the sector employs approximately four million workers, a significant imbalance exists between skilled and unskilled labor. According to the Philippine Construction Industry Roadmap 2020-2030, only 10.8% of the workforce is classified as "skilled." This deficit is further evidenced by industry data showing that 70% of firms identify labor shortages as their top operational challenge, with 90% of hiring difficulties attributed to a lack of technical competency and certification (TESDA, 2020).

Despite this quantifiable gap estimated at up to one million workers women remain an underutilized demographic within the sector. Although the Philippines ranks high in global gender equality indices, female participation in construction is disproportionately low; women constitute only 13% of TESDA-certified individuals in construction trades (TESDA, 2022). Current management literature largely treats female inclusion as a social or policy issue rather than a strategic construction management intervention. There is a notable lack of research on how management practices such as workforce allocation and productivity monitoring can integrate women into skilled roles to mitigate shortages, particularly in the National Capital Region (NCR), which houses

56.1% of the country's construction workforce (Philippine Statistics Authority, 2025).

This study addresses the mismatch between the high demand for skilled labor and the low utilization of trained women. By evaluating women's performance through key indicators safety compliance, work quality, and task efficiency this research aims to identify management strategies that position women as a viable solution to the skilled labor crisis. Ultimately, this study seeks to enhance project performance and industry sustainability by fostering a more inclusive workforce.

LITERATURE REVIEW

Women's Perceptions of Their Roles in Construction. Women's participation in construction is vital not only to fill labor gaps but also to advance gender equality and efficiency, yet the industry remains one of the most gender-segregated globally, with persistent structural and cultural barriers (Bogahawaththage et al., 2025). Despite women comprising only about 10% of the workforce (Adeniji et al., 2022), they face challenges such as discrimination, difficult working conditions, abuse, limited career development, and family obligations. Suggested solutions include flexible work hours, expanded education, training, and professional development to foster inclusivity. The growing shortage of skilled labor presents opportunities for women's greater involvement, and Lean principles particularly continuous improvement and respect for people help dismantle barriers by promoting safety, respect, openness, diversity, and inclusion. Evidence from 27 semi-structured interviews shows that Lean practices enhance team environments and improve women's work experiences, offering a pathway to overcome entrenched challenges in the construction industry (Asadian et al., 2024).

Awareness of Opportunities in Construction. Awareness plays a crucial role in women's career choices in male-dominated fields like construction, where lack of knowledge about opportunities contributes to

underrepresentation (King, 2023). Social stereotypes portraying construction as physically demanding for men limit visibility of roles for women (Dave and Alexander, 2024), but career counseling, school programs, and public campaigns can shift perceptions. The Global Gender Gap Report emphasizes that early exposure to non-traditional careers increases women's likelihood of entering construction and engineering, while Aquino et al. (2023) found that Filipino high school students see minimal limits on opportunities and recognize technology as expanding options for all genders. Research by the Philippine Business Coalition for Women Empowerment (PBCWE, 2019) shows that 90% of women in STEM are aware of personal development opportunities, underscoring the impact of targeted awareness campaigns. Complementing these efforts, the Association of Women Workers in the Construction Industry (AWWCI) leads training, advocacy, and policy initiatives to promote gender-sensitive workplaces and inclusivity, strengthening women's participation in skilled construction roles.

Perceived Challenges in Entering the Industry. New graduates and inexperienced employees face significant challenges entering the construction sector, primarily due to limited practical exposure during academic programs, which creates a skills gap and hinders employability (Sattar & Wazir, 2025). Skill mismatches between higher education and industry needs, such as project management tools, BIM, and sustainable techniques, further slow training and productivity (Toyin & Mewomo, 2023). Safety concerns also leave new workers unprepared for hazardous site conditions, highlighting the need for stronger safety education (Bundalevski & Gjorgjiev, 2025). Restricted industry exposure through internships reduces confidence and proficiency (Kobelo Regalado et al., 2025), while gender inequality discourages women due to entrenched stereotypes and lack of inclusive policies (Amponsah-Asante et al., 2025). Job insecurity from contract-based work (Osifo et al., 2025), pressure to adapt quickly, and

communication gaps with supervisors further complicate transitions, often lowering productivity and confidence (Bahrain et al., 2023). These studies collectively emphasize the importance of collaboration between educational institutions and companies to bridge the gap between training and employment, ensuring graduates are better prepared to meet industry demands.

Motivational Factors Influencing Participation.

Motivation plays a crucial role in participation across education, work, and community activities, with intrinsic motivation driven by personal interest and extrinsic motivation shaped by external rewards (Ellerman, 2021). Deci and Ryan's (1985) Self-Determination Theory highlights autonomy, competence, and relatedness as key psychological needs that foster engagement, while Herzberg's Two-Factor Theory emphasizes achievement, recognition, and meaningful work as motivators (Junejo et al., 2024). In volunteering, Clary et al.'s (1998) Volunteer Functions Inventory identifies six drivers—values, understanding, social, career, protective, and enhancement—showing that aligning motivations with opportunities improves commitment (Zhou & Muscente, 2022). Contextual factors such as peer support, resources, and perceived value also influence participation, underscoring the need for initiatives to address both psychological and situational elements. Overall, effective engagement strategies should match organizational design and communication to participants' motivational needs and aspirations.

Barriers Faced by Women in Construction.

Societal norms and gender stereotypes have long framed construction as a male-dominated field, discouraging women due to beliefs about physical abilities and traditional domestic roles, with surveys showing strong perceptions that men should earn income while women manage households (Tilai et al., 2024; Edirisinghe et al., 2024; Buchhave & Belghith, 2022). Women also face workplace discrimination, including harassment, unequal pay, exclusion from skilled roles, and biased supervision, which

limits career advancement and drives attrition (Ali et al., 2025; King, 2023). Compounding these barriers is limited access to training and skill development, particularly for technical or site-based roles, which widens the skills gap, reduces productivity, and undermines confidence, job satisfaction, and career growth (Afful et al., 2025; Widaningsih et al., 2023; Hassan & Riaz, 2024). These gendered barriers directly impact project performance, contributing to labor shortages, delays, increased costs, and reduced quality, highlighting the need to leverage all available talent, strengthen vocational training, attract younger workers, and adopt technologies such as digital design and automation to lower physical barriers (Hassan & Riaz, 2024; Okoh et al., 2024; Amponsah-Asante et al., 2025). Evidence shows that women's inclusion in construction improves project outcomes, workforce sustainability, and the adoption of innovative practices in emerging areas like green and sustainable construction (Adu Gyamfi et al., 2025).

Women's Contributions to Addressing Labor Shortages.

The construction industry relies on skilled labor to handle complex tasks, but labor shortages have intensified, making women's participation essential for growth and sustainability (Maduekeh et al., 2023; Afful et al., 2025). Scholars note that relying on one gender limits both industry and society, emphasizing that addressing the skills gap requires hiring more women (Oo et al., 2021; Wang et al., 2025). King (2023) showed that women can thrive in skilled roles, motivated by passion and promoting equal opportunities, while bringing critical competencies such as project coordination, communication, precision, teamwork, problem-solving, and confidence (Afful et al., 2025; King, 2023). Their inclusion has been linked to higher productivity, improved safety, stronger teamwork, better client relations, and overall organizational performance (Tilai et al., 2024; King, 2023). Moreover, gender diversity fosters inclusivity, creativity, and innovation, with mixed-gender teams complementing each other's strengths, reducing workplace tensions, enhancing

collaboration, and enabling adaptive, flexible teams that sustain productivity and improve project outcomes (Tuazon et al., 2025; Vedres & Vasarhelyi, 2023). Collectively, these studies highlight that women's participation addresses labor shortages while enhancing workplace performance, diversity, and long-term industry growth.

Construction Management Strategies for Gender Optimization. The construction industry, though increasingly aware of gender equality, still struggles to induct women due to societal stereotypes equating construction with masculinity and physical strength, which discourage women and reinforce traditional caregiver roles (Tilai et al., 2024; Edirisinghe et al., 2024). Workplace discrimination further hinders inclusion, with women facing harassment, limited promotion prospects, and scarce female-friendly policies (Ali et al., 2025), while exclusion from apprenticeships and site-based training perpetuates skill gaps (Widaningsih et al., 2023). Despite these barriers, women's contributions such as project management, accuracy, collaboration, and communication are increasingly recognized as vital for addressing labor shortages and enhancing productivity (Afful et al., 2025). Gender-diverse teams improve problem-solving, reduce accidents, and foster innovation, responsiveness, and inclusiveness (Tuazon et al., 2025). To overcome obstacles, recommended strategies include gender-sensitive recruitment, mentorship, awareness campaigns, and tailored technical training (Kuteesa et al., 2024), alongside supportive workplace policies like flexible schedules, on-site daycare, and anti-harassment measures. Featuring women as role models can further reshape industry perceptions and encourage future participation.

Efficiency Outcomes of Skilled Labor. Skilled labors are essential to improving efficiency and productivity in construction, as their expertise and experience allow them to execute specialized tasks with precision, reducing mistakes, rework, and ensuring compliance with project standards (Maduekeh et al., 2023).

Studies show that a skilled workforce directly impacts project outcomes, with labor skills being crucial even in small- and medium-sized projects (Sattar & Wazir, 2025). In many developing countries, insufficient training among low-skilled labor leads to delays, higher costs, and poor results. Experienced labor proficient in tool handling also reduce accident risks and foster safer, more productive workplaces (Hassan & Riaz, 2024). Skilled tradespeople such as carpenters, electricians, plumbers, masons, and others bring unique technical talents honed through training and practice, making them indispensable to project success. Their strong work ethic, commitment, and dedication to safety underscore their vital role in sustaining the construction industry.

Theoretical Framework. The proposed theoretical framework positions women's inclusion in construction as a strategic solution to labor shortages, grounded in key management theories. The Harvard Human Resource Management (HRM) Model emphasizes considering diverse stakeholders including women workers, employers, HR professionals, training institutions, and government agencies when shaping workforce policies, framing integration not only as a way to fill gaps but also as a long-term HR strategy to enhance performance, cost efficiency, and sustainability despite cultural and structural barriers (West, 2025). Lean Construction principles further highlight the importance of maximizing resources to reduce waste and increase value, with women representing an underutilized resource that can improve productivity, workflow reliability, and collaboration (Aghazadeh, 2025). These gains directly support the Iron Triangle of time, cost, and quality, as labor shortages typically cause delays, higher expenses, and reduced quality, while hiring more women helps managers meet schedules, control costs, and maintain standards (Tijanić, 2025). Overall, the framework illustrates how women's inclusion strengthens HR strategies, enhances productivity through Lean principles, and safeguards project success, offering a

sustainable response to labor shortages in the Philippine construction sector.

Conceptual Framework. The Input–Process–Output (IPO) Model provides a structured framework linking key variables to construction management outcomes. In the Input phase, demographic data and perceptions of women's roles, barriers to participation, contributions to productivity, and efficiency of male and female labor are gathered, reflecting findings that the sector remains male-dominated due to societal expectations, organizational obstacles, and pay inequalities (Gbenga et al., 2023), while women's entry is shaped by significant factors influencing involvement and promotion (Palmer, 2025). The Process phase transforms these inputs into actions through quantitative methods, including systematic data collection, coding, and statistical tools such as weighted mean and paired sample t-tests to identify patterns and differences. Finally, the Output phase converts results into a Construction Management Integration Framework, offering strategies for workforce planning, skill development, and gender inclusion. This evidence-based model demonstrates how managers can enhance diversity, address skill shortages, and improve project performance in terms of time, cost, and quality.

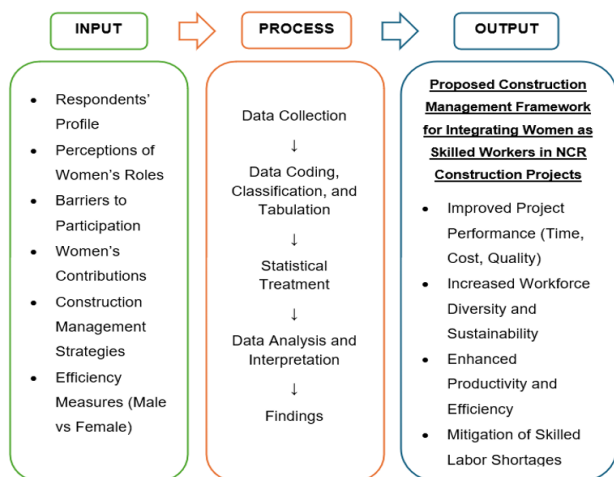


Figure 1
Conceptual Framework of the Study

This suggested research study could help answer the following questions in order to fully analyze the problem and give useful recommendations on how to deal with labor

shortages by using women's potential in the construction industry:

1. What is the demographic profile of the respondents in terms of:
 - 1.1 Age;
 - 1.2 Sex;
 - 1.3 Education;
 - 1.4 Job role;
 - 1.5 Years of experience; and,
 - 1.6 Type of organization?
2. What are the perceptions on women's potential role in construction industry in terms of:
 - 2.1 Awareness of opportunities in construction;
 - 2.2 Perceived challenges in entering the industry; and,
 - 2.3 Motivational factors influencing participation?
3. What are the barriers hindering women's participation in the construction industry based on:
 - 3.1 Societal stereotypes and cultural norms;
 - 3.2 Workplace discrimination and bias; and,
 - 3.3 Lack of access to training and skill development?
4. What specific contributions do women make in addressing labor shortages within the construction industry, particularly in relation to workforce efficiency and productivity, when assessed based on:
 - 4.1 Skillsets and competencies women bring to construction roles;
 - 4.2 Productivity and performance metrics; and,
 - 4.3 Influence on workplace diversity and innovation?
5. What construction management strategies that can be implemented to optimize gender diversity for labor productivity?
6. Are there significant differences in the perceived work efficiency between male and female skilled labor in the construction industry?

Hypothesis. At the 0.05 level of significance, the study will test if there are no statistically significant differences between men and women in terms of work efficiency and productivity within the construction sector.

METHODS

Research Design. This study adopts a quantitative, descriptive-correlational research design to examine how increasing women's participation could help address labor shortages in construction management in the National Capital Region (NCR). The descriptive aspect explores current workforce conditions, hiring practices, management strategies, and challenges affecting labor supply, while the correlational aspect investigates whether greater workforce diversity, particularly with more women, is linked to improved stability, productivity, and project efficiency. A quantitative approach was chosen because construction management research relies on measurable factors such as workforce availability, recruitment methods, and training investment, with structured surveys used to collect numerical data on managers' views and organizational practices. These data are then analyzed using statistical tools appropriate for workforce planning and human resource management research.

Population and Sampling. The target population for this study consists of individuals in the construction industry within the NCR who are engaged in workforce planning, recruitment, project management, and organizational decision-making. Stratified purposive sampling was used to ensure fair representation across essential roles, including project managers, HR officers/managers, government agency officials, training institution representatives, architects, engineers, company executives, and other construction professionals. The sample size was determined based on respondent availability, the need to capture diverse perspectives, and feasibility within the study's timeframe. Eligible participants were those currently working in construction with the required professional or technical roles and

years of experience, while individuals outside the industry, those not meeting criteria, or those providing incomplete or improperly answered surveys were excluded to maintain data reliability and validity.

Instrumentation. The primary instrument for this study is a structured survey questionnaire designed to capture perceptions, experiences, and managerial attitudes toward women in construction and their potential role in addressing labor shortages. Developed from relevant literature on gender participation, workforce development, and labor shortages, the questionnaire aligns with the study's objectives and measures key variables such as women's roles in construction, their contributions to labor supply, managerial strategies for leveraging gender diversity, and the performance of skilled labor. Statements were crafted to assess these indicators and rated on a five-point Likert scale from "Strongly Disagree" (1) to "Strongly Agree" (5). Demographic questions were included to contextualize responses based on job title, years of experience, and organizational affiliation. By combining quantitative data with statistical analysis, the instrument provides evidence-based insights into workforce supply constraints and management interventions, supporting sustainable manpower planning and improved project delivery in the construction industry.

Data Gathering Procedure. Data for this study were collected through a structured survey questionnaire distributed to selected participants in the construction sector, following a formal request and invitation letter that explained the study's purpose and sought voluntary participation. Respondents were provided with an informed consent statement outlining the study's goals, the voluntary nature of participation, and their right to withdraw at any time without repercussions. Once consent was secured, questionnaires were administered both online and in person to reach the targeted respondents. The researcher ensured that instructions and objectives were clearly understood, and completed surveys

were carefully checked for accuracy and completeness before being organized, encoded, and prepared for statistical analysis to achieve the study's objectives.

Data Analysis. The data analysis for the study will employ frequency and percentage distribution to examine categorical variables such as respondents' demographic profiles, providing an overview of how often each category occurs. Mean distribution will be used to analyze Likert-scale responses, identifying the central tendency of participants' opinions, experiences, and attitudes toward women in construction. Finally, the paired sample t-test will compare the means of two related groups or variables, allowing the study to assess changes in perceptions or experiences among the same respondents at different points in time. Together, these statistical methods will provide a comprehensive analysis of workforce diversity, labor shortages, and management practices in the construction sector.

RESULTS

Demographic Profile of the Respondents. Table 1 presents the frequency and percentage distribution of respondents according to age, sex, educational attainment, job role, years of experience, and type of organization. The majority were aged 25–34 (74; 50.00%), followed by 35–44 (28; 18.90%) and 18–24 (26; 17.60%), indicating an active and productive workforce. Most respondents were male (87; 58.80%) versus female (58; 39.20%), reflecting the male-dominated industry. In terms of education, most held a bachelor's degree (131; 88.50%), suggesting technical knowledge and critical thinking relevant to evaluating industry issues. Engineers comprised the largest group (48; 32.40%), followed by HR officers/managers (24; 16.20%) and government agency officials (20; 13.50%), while most had 5–10 years of experience (61; 41.20%), followed by less than 5 years (59; 39.90%). Regarding organizational affiliation, contractors represented the majority (61; 41.20%), followed by consultancy organizations (30; 20.30%), showing strong involvement in operational and managerial

construction activities. Overall, the demographic profile suggested that respondents were young to mid-career professionals with relevant experience and exposure to workplace dynamics, enabling informed perspectives on women's participation in addressing labor shortages.

Table 1
Frequency and Percentage Distribution of Respondents' Demographic Profile

Variable	f	%
Age		
18–24	26	17.60%
25–34	74	50.00%
35–44	28	18.90%
45–54	7	4.70%
55 and above	13	8.80%
Sex		
Male	87	58.80%
Female	58	39.20%
Prefer not to say	3	2.0%
Highest Educational Attainment		
Bachelor's Degree	131	88.50%
Master's Degree	8	5.40%
Others	9	6.10%
Job Role/Position		
Project Manager	15	10.10%
Human Resource Officer/Manager	24	16.20%
Government Agency Official	20	13.50%
Training Institution Representative	17	11.50%
Architect	11	7.40%
Company/Firm Executive	10	6.80%
Engineer	48	32.40%
Others	3	2.0%
Years of Experience		
Less than 5 years	59	39.90%
5–10 years	61	41.20%
11–15 years	12	8.10%
More than 15 years	16	10.80%
Type of Organization		
Contractor	61	41.20%
Consultancy	30	20.30%
Subcontractor	21	14.20%
Government Agency	19	12.80%
Training Institution	17	11.50%

Note: N = 148

These findings were consistent with Priya and Anandh (2024), who reported a relatively young, undergraduate-educated workforce with persistent male dominance; Husam et al. (2024), emphasizing younger professionals' relevance in examining gender inclusivity; Baker et al.

(2021) and Maurer et al. (2021), noting continued male dominance and structural barriers; Infante-Perea et al. (2021) and Dhanasekar et al. (2025), highlighting the role of educated engineers in assessing workplace culture Maliha et al. (2024); emphasizing HR's role in recruitment and workforce planning; and Sharif et al. (2024), highlighting the importance of diverse technical and regulatory perspectives.

Table 2
Perceived Assessment of Women Regarding Their Potential Roles in Construction Industry

Statements	Mean	SD
1. I am aware of the opportunities for women to participate in construction industry roles	4.49	0.705
2. I believe it is challenging for women to enter the construction industry	4.17	0.958
3. Women are motivated to pursue roles in construction due to career growth and income opportunities	4.22	0.804
4. I believe women can succeed in the construction industry with proper organizational support	4.66	0.542
5. Women can handle important construction tasks like scheduling, safety, and quality control	4.81	0.426
6. Women working in construction can help projects get done faster, on budget, and within the quality standards	4.53	0.675
Total Mean	4.48	0.435

Perceptions of Women Regarding Their Potential Roles in the Construction Industry.

Table 2 reveals the respondents' perceptions of women's potential roles in the construction industry, with a total mean of 4.48 (SD = 0.435), indicating strong agreement that women could contribute meaningfully. Item 4 received a mean of 4.66 (SD = 0.542), showing that respondents believed women could succeed when provided training, mentorship, safe environments, and gender-inclusive policies. Item 5 also showed strong agreement (mean = 4.26, SD = 0.426), reflecting recognition of women's competence in technical and managerial roles. Item 2 had the lowest mean of 4.17 (SD = 0.958), indicating acknowledgment of persistent barriers such as gender bias and social norms. These findings aligned with existing literature: García-Herrero et al. (2022) emphasized that research on gender in construction focused on external barriers rather than women's competence, supporting Item 5; Yan et al. (2024) reported that organizational support and female representation targets enabled women's success, consistent with Item 4; Sharif et al.

(2024) highlighted training, mentorship, and institutional support as key enablers, while women remained underrepresented, with only about 1% of trades positions filled by women in 2020, confirming the persistence of structural barriers reflected in Item 2.

Table 3
Perceptions of the Barriers that Hinder Women's Participation in the Construction Workforce

Statements	Mean	SD
1. Societal stereotypes discourage women from pursuing roles in construction.	4.01	0.896
2. Women in construction often encounter discrimination, unequal treatment, or gender bias in the workplace	4.07	0.994
3. Access to training and professional development programs for women aiming for roles in construction is limited	3.64	1.278
4. Family responsibilities and challenges related to work-life balance restrict women's progress in construction careers	3.94	1.032
5. The culture of safety at the worksite and the presence of gender-sensitive amenities (such as separate personal protective equipment and sanitation facilities) play a significant role in shaping women's involvement in construction projects.	4.06	0.905
6. The lack of career advancement and promotion prospects prevents women from seeking long-term careers in the construction industry.	3.77	1.037
Total Mean	3.92	0.763

Barriers Hindering Women's Participation in the Construction Workforce.

Table 3 presents the respondents' perceptions of barriers hindering women's participation in the construction workforce, with a total mean of 3.92 (SD = 0.763), indicating agreement that significant barriers existed despite recognizing women's potential roles. Item 2, stating that "Women in construction often encounter discrimination, unequal treatment, or gender bias in the workplace," received the highest mean of 4.07 (SD = 0.994), highlighting acknowledgment of gender discrimination. Item 5, regarding the role of worksite safety and gender-sensitive amenities such as PPE and sanitation facilities, obtained a mean of 4.06 (SD = 0.905), reflecting agreement that inadequate facilities acted as barriers. In contrast, Item 2.3, on limited access to training and professional development, recorded the lowest mean of 3.64 (SD = 1.278), though perceptions varied, indicating differing awareness among respondents. These findings aligned with existing literature: women frequently faced discrimination, sexist attitudes,

and restricted meaningful work, supporting Item 2; gender bias, income inequality, bullying, and sexual harassment as barriers affecting women's entry and retention; Oo and Lim (2023) found dissatisfaction with PPE historically designed for men, confirming Item 5 and differences in perceived professional barriers, with restricted access to job-related education and development, reinforcing Item 3 as an underrecognized structural barrier.

Women's Contribution to Addressing Labor Shortages in the Construction Industry. Table 4 shows the respondents' perceptions of women's contributions to addressing labor shortages in the construction workforce, with a total mean of 4.43 (SD = 0.558), indicating strong agreement that women enhanced productivity, workplace diversity, leadership, and collaborative decision-making. Item 3, stating that "Women's participation in construction roles enhances workplace diversity, collaboration, and innovation," received the highest mean of 4.48 (SD = 0.665), highlighting recognition of women's impact on teamwork and innovation. Items 5 and 7, stating that "Women are capable of effectively holding leadership or supervisory positions" and "Their involvement enhances collaborative decision-making and improves team dynamics," were tied as second-highest with means of 4.47 (SD = 0.684; 0.643), suggesting respondents perceived women as capable leaders who strengthened collaboration. Item 6, which noted that "Women's participation can enhance project KPIs, including decreased rework, improved schedule compliance, and increased client satisfaction," received the lowest mean of 4.34 (SD = 0.716), though still strongly agreed, indicating perceived improvements in project performance.

These findings were supported by literature, with Dhanasekar & Anandh (2025) reporting that workplace diversity improved coordination, communication, and decision-making, supporting Items 3 and 7, while Husam et al. (2024) found that gender-diverse teams achieved better productivity, reduced material waste, and lower workforce turnover, aligning

with the perceived KPI improvements. This study further contributed by documenting construction professionals' perceptions that women's participation could positively influence project outcomes in the Philippine context.

Table 4
Perceived Women's Contribution to Addressing Labor Shortage in Construction

Statements	Mean	SD
1. Women bring unique skill sets and competencies that are vulnerable in construction management roles	4.43	0.672
2. Women contribute positively to construction productivity, efficiency, and overall performance in construction management	4.46	0.643
3. Women's participation in construction roles enhances workplace diversity, collaboration, and innovation	4.48	0.665
4. Increasing women's involvement in construction roles can help address the current labor shortage	4.37	0.767
5. Women are capable of effectively holding leadership or supervisory positions in construction projects	4.47	0.684
6. The participation of women in construction roles has the potential to enhance project Key Performance Indicator (KPIs), including decreased rework, improved schedule compliance, and increased client satisfaction	4.34	0.716
7. The involvement of women enhances collaborative decision-making and improves team dynamics in construction project management	4.47	0.643
Total Mean	4.43	0.558

Strategies to Enhance Women's Participation in Construction. Table 5 reveals the perceived strategies to enhance women's participation in the construction workforce. The section obtained a total mean of 4.58 (SD = 0.503), indicating that professional respondents strongly agreed that strategies such as strengthened government policies, industry regulations promoting gender equality, and fair HR and contractor practices could enhance women's participation and help address labor shortages in the construction industry. Item 3, which stated that "Government policies and industry regulations should promote gender equality and inclusion in construction management," received the highest mean of 4.64 (SD = 0.651), indicating strong agreement that government and industry-level policies played a crucial role in advancing women's participation. Item 8, which stated that "To make sure that construction companies are fair to both men and women, HR regulations and contractor compliance criteria should be made stronger," ranked second with a mean of 4.63

(SD = 0.598), suggesting that respondents recognized the importance of stronger HR policies and contractor compliance to ensure gender fairness. Meanwhile, Item 2, which stated that “Flexible work arrangements and organizational policies can enhance women's participation in the construction workforce,” recorded the lowest mean of 4.47 (SD = 0.714), though respondents still strongly agreed, indicating that while flexible work arrangements were considered beneficial, their applicability might vary in an industry that often requires on-site and hands-on work.

Table 5
Perceived Strategies to Enhance Women's Participation in Construction

Statements	Mean	SD
1. Mentorship and support programs should be established for women in construction, and also prepare them for management and leadership roles	4.53	0.664
2. Flexible work arrangements and organizational policies can enhance women's participation in the construction workforce	4.47	0.714
3. Government policies and industry regulations should promote gender equality and inclusion in construction management	4.64	0.651
4. Advocacy and awareness campaigns can encourage more women to consider careers in construction	4.62	0.588
5. Gender-sensitive workforce planning should be a part of how projects are planned and resources are used.	4.54	0.653
6. Women in leadership positions should be able to take part in site-based training programs on construction technology like BIM and Lean Construction	4.59	0.615
7. Performance monitoring measures should be put in place to see how women's work contributes to the project's delivery (time, cost, and quality)	4.57	0.671
8. To make sure that construction companies are fair to both men and women, HR regulations and contractor compliance criteria should be made stronger.	4.63	0.598
Total Mean	4.58	0.503

These findings were supported by existing literature emphasizing the importance of institutional support and policy enforcement in improving women's participation in construction. Gender equality in construction remained constrained by structural and systemic issues, highlighting the need for stronger policy interventions. Similarly, Ghanbaripour et al. (2023) identified flexible work arrangements as a strategy for improving women's work experiences, although their effectiveness varied depending on job roles and workplace conditions. Furthermore, Yan et al. (2024) reported that weak gender diversity

cultures in organizations often required stronger formal rules and regulatory enforcement, supporting the respondents' strong agreement that stricter HR policies and contractor compliance mechanisms were necessary to effectively implement gender-inclusive practices in the construction industry.

Measure of Efficiency in Construction Work Across Gender. Table 6 presents the descriptive statistics of professional respondents' perceptions of work efficiency by gender. Overall, female skilled labor (M = 4.34, SD = 0.609) were perceived to outperform male skilled labor (M = 4.19, SD = 0.606), indicating stronger agreement on their efficiency and highlighting their contribution to addressing labor shortages in the construction industry. In the productivity and output dimension, males (M = 4.18, SD = 0.695) slightly outperformed females (M = 4.14, SD = 0.706), mainly due to completing tasks within expected labor hours, although both groups were rated similarly, suggesting room for improvement. For time and schedule commitment, females (M = 4.22, SD = 0.752) exceeded males (M = 4.10, SD = 0.724), reflecting greater adherence to deadlines. Quality and rework showed near-equal scores, with females scoring higher in following drawings/specifications accurately (M = 4.28, SD = 0.798), indicating greater attention to detail. Safety and compliance revealed the largest gap, with females (M = 4.53, SD = 0.638) significantly outperforming males (M = 3.90, SD = 0.781), demonstrating stronger adherence to safety protocols and organized work areas, which supports safer and more efficient project outcomes.

Table 6
Descriptive Statistics of the Perceived Measure of Efficiency in Construction Work Across Male and Female

Statement	Male (M)	SD	Female (M)	SD
Productivity and Output				
Consistently meet/exceed daily output targets	4.20	0.747	4.14	0.774
Complete assigned tasks within expected labor hours	4.23	0.792	4.15	0.786
Maintain steady work pace throughout the day	4.15	0.828	4.17	0.828
Require minimal rework to meet specifications	4.13	0.740	4.10	0.839
Total Mean	4.18	0.695	4.14	0.706

Time & Schedule Commitment				
Finish tasks within scheduled duration	4.14	0.744	4.22	0.772
Avoid causing delays to subsequent tasks	4.07	0.797	4.21	0.810
Total Mean	4.10	0.724	4.22	0.752
Quality & Rework				
Outputs pass inspection on the first attempt	4.03	0.812	3.99	0.769
Follow drawings/specifications accurately	4.18	0.765	4.28	0.798
Helps minimize cost overruns through efficient use of labor	4.20	0.838	4.22	0.823
Total Mean	4.14	0.735	4.16	0.712
Safety & Compliance				
Consistently follow safety protocols and use PPE	3.81	0.891	4.59	0.669
Maintain a safe and organized work area	3.87	0.890	4.57	0.681
Show leadership in toolbox meetings and safety briefings	4.26	0.850	4.43	0.721
Total Mean	3.90	0.781	4.53	0.638
Coordination & Management Practices				
Coordinate effectively with subcontractors and other Stakeholders	4.34	0.735	4.43	0.701
Demonstrate efficiency in using project management tools/software like BIM and scheduling tools	4.32	0.783	4.32	0.756
Contribute positively to conflict resolution within project teams	4.28	0.736	4.44	0.749
Total Mean	4.31	0.687	4.39	0.687
Teamwork & Communication				
Coordinate well with other construction teams	4.34	0.726	4.43	0.720
Communicate clearly about task status and needs	4.30	0.725	4.51	0.685
Enhances collaborative decision-making within teams	4.29	0.712	4.45	0.741
Total Mean	4.31	0.659	4.46	0.678
Independence & Problem-Solving				
Adapt effectively to changes in plans or site conditions	4.34	0.735	4.30	0.788
Resolve minor issues without constant supervision	4.34	0.735	4.31	0.781
Total Mean	4.34	0.695	4.31	0.753
Attendance & Punctuality				
Consistently report to work on time	4.07	0.866	4.47	0.742
Maintain high attendance rates	4.22	0.840	4.50	0.742
Total Mean	4.15	0.813	4.49	0.721
Overall Mean	4.19	0.606	4.34	0.609

Coordination and management practices showed both genders rated as strongly agree, with females scoring higher in conflict

resolution ($M = 4.44$, $SD = 0.749$) and stakeholder coordination ($M = 4.43$, $SD = 0.701$), reflecting more effective teamwork and diplomacy. Teamwork and communication (Item 5.6) also favored females ($M = 4.46$, $SD = 0.678$) over males ($M = 4.31$, $SD = 0.659$), particularly in clear communication and collaborative decision-making, aligning with findings that women enhance workplace diversity and collaboration. Independence and problem-solving showed negligible differences, with males slightly ahead ($M = 4.34$, $SD = 0.695$), indicating both genders are equally capable of handling tasks independently. Attendance and punctuality highlighted females' superior commitment ($M = 4.49$, $SD = 0.721$) compared to males ($M = 4.15$, $SD = 0.813$), with the largest individual difference observed in reporting to work on time ($\Delta = 0.40$), demonstrating that hiring women enhances workforce reliability and project efficiency. Overall, these findings confirm professional respondents perceived female labor as more efficient, disciplined, and safety-conscious, supporting their critical role in addressing labor shortages in the Philippine construction industry.

Table 7
t-Test Results Comparing Efficiency Indicators Between Male and Female Skilled Labor

Efficiency Indicator	t	df	p-value	Effect size
Productivity & Output	0.674	147	.501	0.055
Time & Schedule Commitment	-1.982	147	.049	-0.162
Quality & Rework	-0.470	147	.639	-0.038
Safety & Compliance	-9.020	147	<.001	-0.741
Coordination & Management Practices	-1.625	147	.106	-0.133
Teamwork & Communication	-2.968	147	.004	-0.244
Independence & Problem-Solving	0.629	147	.531	0.051
Attendance & Punctuality	-5.264	147	<.001	-0.432
Overall	-4.077	147	<.001	-0.335

Table 7 elucidates the results of the paired sample t-test, revealing significant differences in perceived efficiency between male and female skilled labor across eight dimensions. Overall, female skilled labor outperformed males ($t = -4.077$, $df = 147$, $p < .001$, effect size = -0.335), rejecting the null hypothesis and indicating that women's participation enhances construction workforce efficiency. In productivity and output, males slightly outscored females ($t = 0.674$, $p = .501$, effect size = 0.055), but the difference was negligible,

confirming equal efficiency in task completion. For time and schedule commitment, females scored higher ($t = -1.982$, $p = .049$, effect size = -0.162), demonstrating superior adherence to schedules, while quality and rework showed no significant difference ($t = -0.470$, $p = .639$, effect size = -0.038). In safety and compliance, females significantly outperformed males ($t = -9.020$, $p < .001$, effect size = -0.741), consistently following safety protocols and maintaining organized work areas, highlighting women's critical role in reducing risks and improving outcomes. Coordination and management practices showed no significant difference ($t = -1.625$, $p = .106$, effect size = -0.133), whereas teamwork and communication favored females ($t = -2.968$, $p = .004$, effect size = -0.244), reflecting better collaboration and communication skills. Independence and problem-solving revealed no significant difference ($t = 0.629$, $p = .531$, effect size = 0.051), indicating equal ability to work independently and adapt to site challenges. Attendance and punctuality showed a significant advantage for females ($t = -5.264$, $p < .001$, effect size = -0.432), reflecting higher reliability and work commitment, aligned with Priya and Anandh (2024). These findings confirm that female labor are as productive as males in operational functions (Husam et al., 2024), while demonstrating superior performance in safety, schedule compliance, communication, and attendance, justifying their role in addressing labor shortages and enhancing efficiency in the Philippine construction industry.

Construction Management Practices Supporting Women's Roles in Construction. For this study, six major themes described construction management practices affecting women's participation: Gendered Task Allocation and Role Stereotyping, Gender-Exclusive Safety Planning and On-Site Facilities, Inflexible Scheduling as a Structural Barrier, Unequal Access to Training and Leadership Development, Workplace Culture, Harassment, and Gender Bias, and Mentorship and Institutional Support Systems. Theme 1 revealed that task assignments were influenced by gender norms rather than skills, with women

disproportionately assigned to office and clerical roles despite being qualified for technical and supervisory positions (Respondents 8, 23, 25, 34, 38), prompting recommendations for competency-based allocation systems (Respondents 25, 38). Theme 2 highlighted that PPE and site infrastructure were designed primarily for men, creating safety barriers, and respondents advocated gender-responsive safety audits and facilities to retain women in field roles (Respondents 32, 38, 60). Theme 3 showed that inflexible, long-hour schedules disadvantaged women with caregiving responsibilities, leading to suggestions for flexible shifts, output-based scheduling, and remote coordination options (Respondents 32, 40, 87). Theme 4 revealed unequal access to training and leadership development, with women often excluded from technical programs and mentorship opportunities, and respondents recommended task rotation, gender-inclusive training, and government-led vocational programs (Respondents 37, 52, 87, 124). Theme 5 addressed workplace culture, harassment, and gender bias, with respondents noting verbal abuse, exclusion, and unequal treatment, emphasizing the need for clear policies, accountability, and leadership support for gender equity (Respondents 64, 77, 84). Theme 6 highlighted mentorship and institutional support as critical for confidence, visibility, and career progression, with formal programs, gender-neutral job descriptions, and KPIs seen as essential for systemic change (Respondents 32, 93, 133, 143, 146, 147). Across all themes, barriers were rooted not in women's competencies but in organizational practices, cultural norms, and male-centered assumptions, suggesting reforms across project-level task allocation, scheduling, organizational training, mentorship, and industry-wide cultural shifts to enhance gender inclusion and equity (Braun & Clarke, 2006).

DISCUSSION

This study investigated the role of women as skilled labor in addressing labor shortages in the Philippine construction industry, focusing on

the National Capital Region, using a quantitative descriptive-correlational design with structured survey questionnaires distributed to construction professionals. Respondents generally viewed women's participation positively, noting increasing awareness of industry opportunities, though challenges such as limited exposure, safety issues, and skill gaps persisted. Both intrinsic and extrinsic motivational factors influenced women's engagement, and respondents agreed that women were capable of technical, supervisory, and managerial roles. Societal stereotypes, workplace discrimination, and limited access to training were identified as barriers, reducing the skilled labor pool and negatively affecting project performance in terms of schedule, cost efficiency, and quality. The study found that women contributed significantly to skilled trades and site-based roles, enhancing communication, coordination, attention to detail, teamwork, collaboration, and innovation, which improved productivity, efficiency, and overall project outcomes. Statistical analysis showed that female labor outperformed males in safety compliance, time management, teamwork, and attendance, while no significant differences were found in productivity, output quality, coordination, or problem-solving, indicating that women demonstrated equal competence in technical domains and stronger performance in management-related areas.

Based on these findings, women were recognized as competent contributors whose participation addressed labor shortages and improved project outcomes, while societal and organizational barriers limited their full engagement. Respondents supported gender-inclusive construction management strategies, including gender-sensitive recruitment, equal training access, policy enforcement, and inclusive workplace practices, with adaptations such as flexible schedules recommended for specific contexts. Recommendations included prioritizing women for skilled site jobs, implementing gender-responsive site practices and safety measures, assigning women to operational and quality-control roles to enhance efficiency, incorporating competency-

based evaluation systems, and promoting inclusive management of diverse crews. Future research was advised to examine women's performance in skilled trades, productivity impacts over time, effectiveness of training and certification programs, and site management strategies that sustain women's participation and career advancement in construction.

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Artificial intelligence use. Google Gemini and NotebookLM was used to generate initial thoughts and organize these ideas. Grammarly was used to improve clarity and accuracy, and QuillBot was used to help rewrite sentences. These tools were only used to help with language and ideas. The researcher carefully checked, validated, and finalized all sources, analysis, and final materials in line with academic research standards.

Ethics approval statement. Ethical approval was obtained from the University Research Ethics Committee of the Polytechnic University of the Philippines-Open University System, with reference code OUSREC 1001-0018.

Data availability statement. All data supporting the findings of this study are included within the manuscript and its supplementary materials.

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