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Original Article

Investigating the Women's Challenges in the Construction Project in Banda Aceh, Indonesia: A Thematic Analysis

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Abstract: The construction project remains male-dominated, and women engineers continue to face structural, cultural, and organizational challenges. Despite increasing women's participation in engineering education, their representation and career advancement in construction remain limited, particularly in developing regions such as Banda Aceh, Indonesia. Existing studies have largely focused on general barriers to women's participation, with limited attention to context-specific and experiential insights of women engineers. Therefore, this study analyzes the challenges faced by women engineers on construction projects in Banda Aceh, Indonesia. This research employs a mixed-methods approach, combining quantitative data from structured questionnaires with qualitative insights from open-ended responses. A total of 149 respondents were purposively selected from three universities. Quantitative data were analyzed using descriptive statistics, and qualitative data were examined using thematic analysis assisted by NVivo 14. The findings reveal that the most significant challenges include perceived physical limitations, lack of training and practical guidance, work–life balance issues, low recruitment of women workers, and mismatches between education and job roles. Thematic analysis further confirms that structural and capacity-related barriers are the most dominant, followed by socio-cultural norms and organizational constraints. Issues such as discrimination and wage gaps were reported at lower levels but remain relevant. This study concludes that women engineers face multidimensional challenges shaped by both structural and socio-cultural factors. Policy implications include the need for inclusive recruitment practices, targeted training programs, flexible work policies, and increased visibility of women role models. However, the study is limited to a specific regional context and to early-career respondents, suggesting the need for broader, longitudinal research in future studies.

Keywords: Women Engineers; Construction Project; Women Challenges; Thematic Analysis; Banda Aceh context.

1. Introduction

Human resources play a pivotal role in determining the success and sustainability of construction projects, as project outcomes are highly dependent on the quality, competence, and diversity of the workforce involved (Gunarso & Susila, 2018). Despite the increasing demand for skilled labor in the construction sector globally, the industry continues to be characterized by a persistent gender imbalance, with women remaining significantly underrepresented (Clarke et al., 2005; Seidu et al., 2022). Traditionally perceived as a man-dominated field requiring physical strength and endurance, the construction project has long perpetuated structural and cultural barriers that limit women's participation and career advancement (Aulin & Jingmond, 2011; Patel & Pitroda, 2016).

The existing literature highlights that women professionals in construction frequently encounter multidimensional challenges, including gender discrimination, limited career opportunities, a lack of organizational support, and negative workplace perceptions of their competence (Anuar et al., 2017; Salama & Widaningsih, 2022). These challenges are further compounded by socio-cultural norms and gender stereotypes that shape women's career choices and restrict their participation in technical and managerial roles (Akinlolu & Haupt, 2020; Vijayaragunathan & Rasanthi, 2019). For instance, women are often required to negotiate their professional identity within a masculine work culture while simultaneously managing expectations related to family and domestic responsibilities (Kumar & Chaturvedi, 2018; Rosa et al., 2017). Such conditions create a complex environment that affects not only women's entry into the construction project but also their persistence and long-term career development (Graham, 1997; Moore, 2006).

Furthermore, empirical evidence from various national contexts reveals that women's participation in construction remains disproportionately low. Studies in Indonesia indicate that women's representation in construction projects is still limited, with women predominantly occupying lower-skilled or administrative roles rather than technical or leadership positions (Indryani et al., 2025; Rahardjo et al., 2022). Similar patterns have been observed globally, where women constitute a minority of the workforce and face systemic barriers such as unequal pay, lack of mentorship, and limited access to training opportunities (Wang et al., 2021; Wells et al., 2025). Even in more developed contexts, such as the United Kingdom and Australia, the construction sector continues to struggle with gender diversity and inclusion, highlighting the deeply rooted nature of these challenges (Shanmugam et al., 2007; Edirisinghe et al., 2025).

In addition, workplace conditions on construction projects, such as long working hours, physically demanding tasks, exposure to harsh environments, and safety risks, pose additional obstacles for women, particularly in balancing professional and personal responsibilities (Kumar & Chaturvedi, 2018; Al Salaheen et al., 2024). Technological advancements associated with Industry 4.0 have been suggested as potential solutions to mitigate some of these barriers; however, their adoption remains uneven, and their impact on gender inclusivity is still evolving (Al Salaheen et al., 2024). Consequently, despite increasing awareness and policy efforts to promote gender equality, progress in achieving meaningful inclusion of women in construction remains slow and fragmented (Clarke et al., 2005; Wright, 2014).

In the Indonesian context, particularly in regions such as Banda Aceh, socio-cultural and religious values play a significant role in shaping gender roles and occupational choices. These contextual factors may further influence women's participation in construction, yet empirical investigations in this specific setting remain limited. While prior studies have examined women's roles and challenges in construction across different regions, there is a noticeable lack of in-depth qualitative research focusing on the lived experiences of women engineers in Banda Aceh. Most existing studies tend to adopt quantitative approaches or focus on broader national or international contexts, thereby overlooking localized socio-cultural dynamics and individual narratives (Saksena et al., 2020; Anuar et al., 2017).

Several gaps can be identified. First, there is limited research using qualitative methods, particularly thematic analysis, to explore the nuanced experiences and challenges women engineers face on construction projects. Second, existing studies largely focus on general women's participation rather than specifically examining professional engineers, who occupy critical technical and decision-making roles. Third, there is a lack of context-specific research in Banda Aceh, where unique socio-cultural, institutional, and economic factors may shape women's experiences differently from those in other regions. Addressing these gaps is essential to providing a more comprehensive understanding of the challenges women engineers face in construction projects.

Despite the growing number of women pursuing education in engineering and construction-related fields, their participation in the construction workforce remains disproportionately low. Women who enter the industry continue to face structural, cultural, and organizational barriers that hinder their career progression and professional development. In Banda Aceh, these challenges may be further intensified by local socio-cultural norms and limited institutional support. However, there is insufficient empirical evidence capturing the specific challenges women engineers face in this region, particularly from a qualitative perspective that emphasizes their lived experiences. In light of these issues, this study aims to analyze the

challenges faced by women engineers on a construction project in Banda Aceh, Indonesia, using a thematic analysis approach. Specifically, the study seeks to explore the lived experiences of women engineers, identify key barriers to their participation and career development, and provide insights to inform policies and strategies that promote gender inclusivity in the construction sector.

This study contributes to the theoretical development of gender and construction literature by integrating gendered organizational structure theory, socio-cultural norms perspective, and empowerment theory to explain the multidimensional challenges faced by women engineers. Unlike prior studies that primarily focus on general barriers, this research develops a context-sensitive framework that links structural constraints (e.g., recruitment practices and training access), socio-cultural influences (e.g., gender norms and expectations), and individual capacity factors (e.g., skills and career adaptation). By combining these perspectives, the study extends existing theories by demonstrating how local socio-cultural contexts, particularly in Banda Aceh, interact with institutional and organizational structures to shape women engineers' experiences. This provides a more holistic and contextually grounded understanding of gender inequality in the construction sector.

2. Literature Review

2.1. Gendered Structure of the Construction Project

The construction project has long been characterized as a man-dominated sector, shaped by entrenched cultural norms, organizational practices, and occupational stereotypes that privilege masculine identities (Clarke et al., 2005; Aulin & Jingmond, 2011). These structural conditions contribute to persistent gender inequality, where women remain underrepresented across both technical and managerial roles (Seidu et al., 2022; Edirisinghe et al., 2025). While global discourse increasingly emphasizes gender diversity as a driver of productivity and innovation, the construction sector continues to lag behind other industries in achieving meaningful inclusion (Rosa et al., 2017; Wang et al., 2021). Scholars argue that the man-dominated culture of construction is not merely a reflection of workforce composition but is deeply institutionalized through recruitment practices, workplace norms, and informal networks that exclude women (Akinlolu & Haupt, 2020).

This is reinforced by the perception that construction work requires physical strength and endurance, thereby discouraging women's participation (Patel & Pitroda, 2016). However, such assumptions have been increasingly challenged, as evidence shows that technical competence and managerial capability are not inherently gendered (Indryani et al., 2025). Despite this, the persistence of gender stereotypes continues to shape organizational behavior and limit women's opportunities. Critically, much of the existing literature tends to treat construction projects as uniformly exclusionary, failing to adequately account for regional and cultural variations. For instance, while studies in Europe and Australia highlight institutional barriers and policy gaps (Clarke et al., 2005; Rosa et al., 2017), these findings may not fully capture the socio-cultural complexities present in developing regions such as Indonesia. This indicates the need for more localized and context-sensitive analyses.

2.2. Barriers and Challenges Faced by Women in Construction

A substantial body of research identifies multiple barriers faced by women in the construction project, which can be broadly categorized into structural, organizational, and socio-cultural challenges. Structural barriers include limited access to employment opportunities, unequal pay, and underrepresentation in leadership positions (Wang et al., 2021; Wells et al., 2025). Organizational barriers, on the other hand, encompass workplace discrimination, lack of mentorship, and inadequate institutional support systems (Anuar et al., 2017; Salama & Widaningsih, 2022). Socio-cultural barriers are particularly significant, as they shape both women's career choices and their workplace experiences. Gender stereotypes and societal expectations often position women as less capable in technical fields, leading to discrimination and marginalization (Vijayaragunathan & Rasanthi, 2019; Akinlolu & Haupt, 2020). Furthermore, women are frequently required to balance professional responsibilities with domestic roles, creating additional pressures that hinder career advancement (Kumar & Chaturvedi, 2018; Rosa et al., 2017).

Empirical studies provide further evidence of these challenges. For example, Anuar et al. (2017) identify work environment, family commitments, and sexual harassment as major barriers, while Saksena et al. (2020) highlight limited job opportunities and long working hours as key constraints. Similarly, Aulin and Jingmond (2011) argue that women often face identity conflicts, as they are expected to conform to masculine workplace norms while maintaining their gender identity. However, existing studies often adopt a problem-focused perspective, emphasizing barriers without sufficiently exploring how women navigate and respond to these challenges. This creates a gap in understanding the agency, resilience, and coping strategies of women professionals, which are crucial for developing effective interventions.

2.3. Women's Career Development and Participation

Research on women's career development in construction suggests that entry into the industry is influenced by a combination of individual, social, and institutional factors (Moore, 2006; Graham, 1997). Early exposure to engineering-related fields, family support, and educational opportunities all play significant roles in shaping women's career trajectories (Graham, 1997). However, even when women enter the industry, their career progression is often hindered by systemic barriers. Studies in different contexts reveal that women's participation in construction remains low despite increasing enrollment in engineering education (Rahardjo et al., 2022; Gunarso & Susila, 2018). In Indonesia, for instance, women are more likely to occupy lower-skilled roles, reflecting both educational disparities and labor market segmentation (Gunarso & Susila, 2018). Similarly, global studies indicate that women are underrepresented in senior and decision-making positions, highlighting the existence of a "glass ceiling" within the industry (Wells et al., 2025; Edirisinghe et al., 2025).

Notably, Rosa et al. (2017) identify key success factors for women in construction, including determination, independence, and adaptability. While these findings provide valuable insights, they also raise critical questions about the extent to which success is framed as an individual responsibility rather than a structural issue. This individualistic framing may obscure the need for systemic reforms and organizational change. Moreover, initiatives aimed at increasing women's participation, such as training programs and policy interventions, have shown mixed results. Wright (2014) highlights the potential of targeted programs to improve women's access to employment opportunities, yet also emphasizes the need for sustained institutional commitment. This suggests that while interventions can be effective, they must be integrated into broader structural reforms to achieve long-term impact.

2.4. Emerging Perspectives: Technology, Empowerment, and Policy

Recent studies have begun exploring new approaches to addressing gender inequality in construction, including the roles of technology, empowerment frameworks, and policy interventions. The advent of Industry 4.0 technologies, such as automation and digital construction tools, has been identified as a potential enabler of gender inclusivity by reducing the physical demands of construction work (Al Salaheen et al., 2024). However, the extent to which these technologies are accessible and beneficial to women remains uncertain, particularly in developing contexts. The concept of empowerment has also gained attention as a framework for understanding women's experiences in construction. Wang et al. (2021) argue that empowerment encompasses personal, relational, and environmental dimensions, highlighting the need to address both individual capabilities and structural constraints. This perspective shifts the focus from barriers to opportunities, emphasizing women's agency and capacity for change.

Policy interventions and institutional support mechanisms are equally important in promoting gender equality. Studies suggest that government policies, organizational practices, and industry initiatives play a crucial role in shaping women's participation in construction (Clarke et al., 2005; Seidu et al., 2022). However, there is often a gap between policy discourse and practical implementation, limiting the effectiveness of these measures. Critically, while these emerging perspectives offer promising avenues for addressing gender inequality, they remain underexplored in specific local contexts. In particular, there is limited research examining how technological, empowerment, and policy frameworks intersect with socio-cultural factors in regions such as Banda Aceh.

The literature demonstrates that gender inequality in the construction project is a multifaceted issue shaped by structural, organizational, and socio-cultural factors. While significant progress has been made in identifying barriers and challenges, existing studies exhibit several limitations. First, there is a tendency to generalize findings across different contexts, overlooking local socio-cultural dynamics. Second, many studies rely on quantitative approaches, which may not capture the depth and complexity of women's lived experiences. Third, there is limited focus on women engineers as a distinct professional group, despite their critical role in the construction sector. In response to these limitations, this study adopts a qualitative thematic analysis approach to explore the challenges faced by women engineers in Banda Aceh. By focusing on lived experiences and contextual factors, this research aims to provide a more nuanced understanding of women challenges in the construction project and contribute to the development of more inclusive policies and practices.

3. Materials and Methods

This study examines the challenges faced by women engineers on a construction project in Banda Aceh, Indonesia, using a mixed-methods approach that integrates quantitative and qualitative data to provide a comprehensive understanding of the phenomenon (Creswell & Plano Clark, 2018). The research focuses on women engineers who graduated at least three years ago from Civil Engineering undergraduate programs at Universitas Syiah Kuala (USK), Universitas Muhammadiyah Aceh (UNMUHA), and Universitas Iskandar Muda (UNIDA). A purposive sampling technique was employed to ensure that selected respondents

possess relevant professional experience in the construction sector. The total population consisted of 243 women graduates, from which a sample of 149 respondents was determined using the Krejcie and Morgan formula, ensuring adequate representation of the population.

Data were collected through a structured questionnaire comprising both closed-ended and open-ended questions. The closed-ended items utilized a Guttman scale (Yes/No) to generate quantitative data, while the open-ended questions allowed respondents to provide deeper insights into their experiences and perspectives. Primary data were obtained directly from respondents, whereas secondary data, including graduate statistics, were sourced from university databases and institutional records. To ensure the quality of the research instrument, a pilot test involving 40 respondents was conducted. The instrument's validity was assessed using Pearson's correlation, and reliability was evaluated using Cronbach's Alpha, with a minimum threshold of 0.60 considered acceptable (Sekaran & Bougie, 2016). Data analysis was conducted using both quantitative and qualitative techniques. Quantitative data were analyzed using descriptive statistics, including frequencies, percentages, and mean values, to summarize respondent characteristics and identify dominant challenges. Meanwhile, qualitative data from open-ended responses were analyzed using thematic analysis to identify key patterns and themes related to the lived experiences of women engineers. The integration of these methods enables a more holistic interpretation of the challenges women engineers face on the construction project in Banda Aceh. Thematic analysis in this study is facilitated by NVivo 14, a software designed to streamline the qualitative data analysis process by categorizing, organizing, and managing collected data.

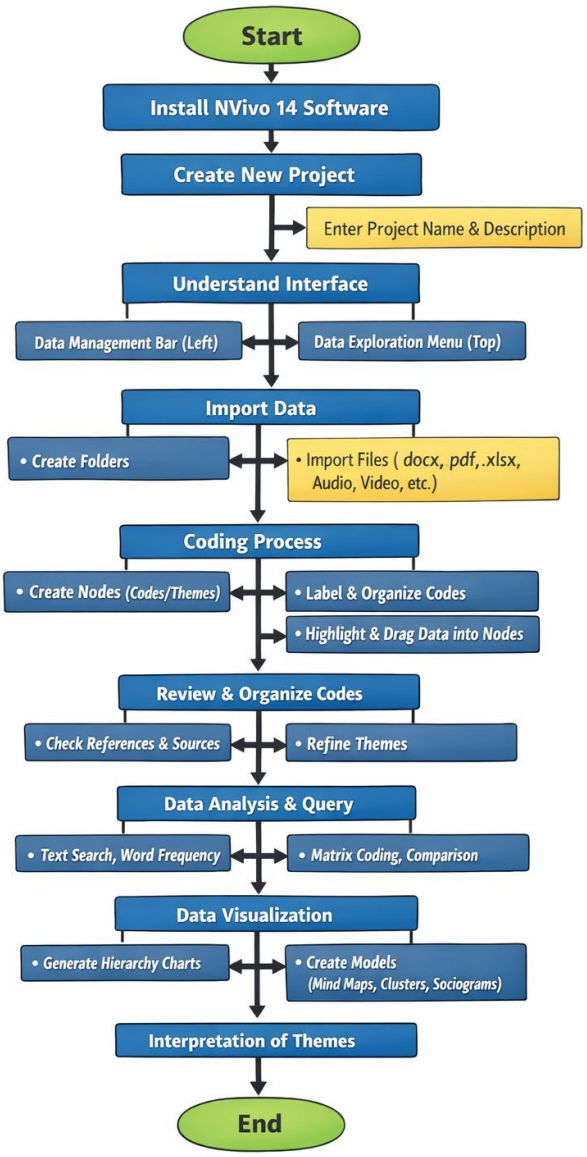

Figure 1. Flowchart – Step-by-Step NVIVO Data Analysis

Figure 1 shows that the analysis began with installing NVivo 14 and creating a new project, assigning a specific title and description to ensure proper data organization. The NVivo interface consists of a data management panel for storing files and codes, and an exploration panel for conducting analytical queries and visualizations. Next, qualitative data, including interview transcripts, documents, and multimedia files, were imported into the software. NVivo supports multiple file formats, allowing flexibility in handling diverse data sources. The core stage involved coding, in which meaningful segments of data were labeled as nodes (themes). Codes were created, organized into folders, and populated by dragging relevant data excerpts. This step enabled systematic categorization and theme development. Subsequently, the coded data were analyzed using NVivo's query tools, such as text search and matrix coding, to identify relationships and patterns. Finally, results were visualized using hierarchy charts and other graphical tools to support the interpretation and presentation of findings. This structured NVivo-based workflow ensured a rigorous, transparent, and reproducible thematic analysis process.

4. Results

4.1. Respondent Characteristics

Table 1 presents the characteristics of the respondents, providing an overview of their age distribution, educational background, university origin, year of graduation, field of work, and work experience. This profile is essential for contextualizing the findings and ensuring that the respondents adequately represent early-career women engineers on the construction project in Banda Aceh.

Table 1. Result of Respondent Characteristics

Category	Description	Frequency	Percentage
Age	20–25 years	37	31
	25–30 years	82	68
	30–35 years	2	2
	>40 years	0	0
Education	Bachelor/Diploma IV (S1/D4)	121	100
University Origin	Universitas Syiah Kuala (USK)	52	43
	Universitas Muhammadiyah Aceh (UNMUHA)	55	45
	Universitas Iskandar Muda (UNIDA)	14	12
Year of Graduation	2022	57	47
	2023	50	41
	2024	14	12
Field of Work	Government Sector	18	15
	– Technical Staff	2	2
	– Junior Expert Auditor	6	5
	– Community Facilitator	4	3
	– Facilitator Staff	1	1
	– Verifier	1	1
	– Junior Road & Bridge Specialist	1	1
	– Technical Staff	1	1
	State-Owned Enterprise (SOE)	1	1
	– Marine Admin (TAD)	1	1
	Planning Consultant	39	32
	– Drafter	7	6
	– Consultant Administration	15	12
	Supervising Consultant	22	18
	– Surveyor	10	8
	– Supervisor	9	7
	Contractor	41	34
	– Site Engineer / Field Executor	6	5
	– Quantity Surveyor	11	9
	– Freelance Worker	5	4
	– HSE Staff	5	4

Category	Description	Frequency	Percentage
	– Project Administrator	12	10
	– Estimator	5	4
	– Scheduler	4	3
	– Quality Control	6	5
	– HSE Administrator	8	7
	– Project Control	1	1
Work Experience	< 1 year	19	16
	1 year	39	32
	1.5 years	8	7
	2 years	47	39
	2.5 years	2	2
	3 years	6	5

Table 1 indicates that in terms of age distribution, the majority of respondents fall within the 25–30 years category, accounting for 82 individuals (68%), followed by those aged 20–25 years with 37 respondents (31%). Only 2 respondents (2%) are aged 30–35 years, while no respondents are aged 40 or older. This indicates that the sample is heavily dominated by young professionals, reflecting the early-career stage of most women engineers in the study. Such a distribution is consistent with the study's focus on recent graduates and highlights the transitional phase from education to professional practice. Regarding educational background, all respondents (121 individuals or 100%) hold a Bachelor's or Diploma IV (S1/D4) degree in Civil Engineering or related fields. This uniformity ensures that all participants have comparable academic qualifications, thereby strengthening the validity of comparisons of professional experiences and challenges.

Regarding university origin, the respondents are evenly distributed across three institutions. The largest proportion comes from Universitas Muhammadiyah Aceh (UNMUHA) (55 respondents or 45%), followed closely by Universitas Syiah Kuala (USK) (52 respondents or 43%), while Universitas Iskandar Muda (UNIDA) contributes 14 respondents (12%). This distribution suggests that the sample captures a broad representation of women engineering graduates in Banda Aceh, although it is slightly skewed toward the two major universities. In terms of year of graduation, most respondents graduated in 2022 (57 respondents, or 47%), followed by 2023 (50 respondents, or 41%), and a smaller proportion from 2024 (14 respondents, or 12%). This pattern further confirms that the respondents are predominantly recent graduates, which aligns with the study's objective of examining early-career challenges faced by women engineers entering the construction project.

The field of work shows a diverse distribution across different sectors within the construction project. The largest proportion of respondents works in the contractor sector (41 respondents, or 34%), followed by planning consultants (39 respondents, or 32%) and supervising consultants (22 respondents, or 18%). A smaller proportion is employed in the government sector (18 respondents or 15%), while only 1 respondent (1%) works in a state-owned enterprise (SOE). Within the contractor sector, roles such as project administrator (10%), quantity surveyor (9%), and HSE administrator (7%) are among the most common positions. In the consulting sector, consultant administration (12%) and drafter roles (6%) dominate, whereas in supervising consultancy, surveyors (8%) and supervisors (7%) are prominent. This distribution indicates that women engineers are more concentrated in supporting, administrative, and mid-level technical roles, with relatively limited representation in high-level technical or managerial positions. It also reflects the role segmentation within the construction project, where women may be more likely to occupy positions perceived as less physically demanding or more administratively oriented.

Finally, respondents' work experience shows that most have relatively limited professional experience. The largest group has 2 years of experience (47 respondents, or 39%), followed by those with 1 year (39 respondents, or 32%) and less than 1 year (19 respondents, or 16%). Smaller proportions include those with 1.5 years (7%), 2.5 years (2%), and 3 years (5%) of experience. This indicates that the majority of respondents are in the early stages of their careers, which is particularly relevant for understanding initial barriers, adaptation challenges, and workplace experiences.

4.2. Challenge Analysis

The descriptive analysis in this section aims to provide an overview of the frequency distribution and percentage of respondents' answers to the questionnaire items. Given that this study employs the Guttman scale, the data are dichotomous, yielding clear and consistent responses to the measured indicators. The Guttman scale used in this analysis is intended to identify respondents' absolute tendencies, with only two

mutually exclusive response options: Yes = 1 and No = 0. Through percentage calculations, the researcher can clearly observe the proportion of respondents who agree or disagree with each indicator, without ambiguity or neutral positions. The detailed results of the descriptive analysis are presented in Table 3.

Table 2. Result of Descriptive Analysis for the Challenges Variable

Challenges	Mean	Rank	Category
Physical capability of women	0.884	1	High
Lack of training and practical work guidance	0.818	2	High
Perception of work–life balance	0.810	3	High
Lack of interest in the construction project	0.760	4	High
Mismatch between educational background and job	0.752	5	High
Low recruitment of women workers	0.752	6	High
Inflexible working hours	0.711	7	Medium
Socio-cultural norms and expectations	0.686	8	Medium
Workplace relationships	0.678	9	Medium
Lack of successful women career role models	0.645	10	Medium
Societal culture and perceptions	0.645	11	Medium
Workload	0.636	12	Medium
Lack of technical skills	0.603	13	Medium
Being treated differently due to gender	0.570	14	Low
Work environment	0.570	15	Low
Limited opportunities for self-development	0.562	16	Low
Lack of visibility and recognition	0.512	17	Low
Sexual discrimination	0.430	18	Low
Health issues	0.388	19	Low
Knowing others who experience discrimination	0.339	20	Low
Experiencing sexual harassment	0.298	21	Low
Gender-based wage gap	0.298	22	Low

Table 2 presents the results of the descriptive analysis of challenges faced by women engineers in the construction project in Banda Aceh, based on mean values, rankings, and categorical classifications. The findings reveal varying levels of challenges, categorized into high, medium, and low, reflecting the relative intensity of each issue as perceived by respondents. At the highest level of challenges, the most dominant issue identified is women's physical capability, with the highest mean score of 0.884 (Rank 1, High category). This indicates that physical demands in construction work remain a primary concern and are perceived as a significant barrier for women engineers. This is followed by the lack of training and practical work guidance with a mean of 0.818 (Rank 2, High), suggesting that insufficient access to hands-on experience and mentorship limits women's professional development.

The third-highest challenge is the perception of work–life balance, with a mean of 0.810 (Rank 3, High), highlighting the difficulty women engineers face in balancing professional responsibilities with personal or family roles. Additionally, lack of interest in the construction project (Mean = 0.760, Rank 4, High) suggests that the industry may still be perceived as less attractive to women. This is closely followed by a mismatch between educational background and job (Mean = 0.752, Rank 5, High) and low recruitment of women workers (Mean = 0.752, Rank 6, High), both indicating structural issues in employment alignment and hiring practices within the construction sector. Moving to the medium category of challenges, inflexible working hours ranks highest within this group with a mean of 0.711 (Rank 7, Medium), reflecting the rigid nature of construction schedules. This is followed by socio-cultural norms and expectations (Mean = 0.686, Rank 8, Medium), which suggests that traditional values and gender roles still influence women's participation in the industry.

Workplace relationships (Mean = 0.678, Rank 9, Medium) also emerge as a moderate challenge, indicating the importance of interpersonal dynamics in shaping workplace experiences. Further medium-level challenges include a lack of successful women career role models (Mean = 0.645, Rank 10, Medium) and societal culture and perceptions (Mean = 0.645, Rank 11, Medium), both of which point to the limited visibility of women in leadership roles and the persistence of gender stereotypes. Workload (Mean = 0.636, Rank 12, Medium) and lack of technical skills (Mean = 0.603, Rank 13, Medium) also contribute to the challenges, suggesting both organizational and individual capacity-related factors. In contrast, the low category of challenges includes factors that, while present, are perceived as less significant by respondents.

These include being treated differently due to gender and work environment, both with a mean of 0.570 (Ranks 14 and 15, Low). Similarly, limited opportunities for self-development (Mean = 0.562, Rank 16, Low) and lack of visibility and recognition (Mean = 0.512, Rank 17, Low) indicate relatively lower perceived impact.

More sensitive issues, such as sexual discrimination (Mean = 0.430, Rank 18, Low) and experiencing sexual harassment (Mean = 0.298, Rank 21, Low), are reported at lower levels, along with health issues (Mean = 0.388, Rank 19, Low) and gender-based wage gap (Mean = 0.298, Rank 22, Low). Additionally, knowing others who experience discrimination (Mean = 0.339, Rank 20, Low) also falls within this category. While these issues are categorized as low, their presence still indicates underlying concerns that should not be overlooked.

4.3. Thematic Analysis

The thematic analysis was conducted to explore in depth the qualitative data obtained from open-ended questionnaires completed by 121 respondents. This analysis was conducted systematically using NVivo 14 to identify patterns, categories, and key themes related to the challenges faced by women engineers on the construction project in Banda Aceh. The visualization is presented as a hierarchy chart, where the size of each box represents the frequency of themes or words in respondents' open-ended responses. The results of the thematic analysis.

Figure 2. Thematic Analysis Visualization of Challenges Faced by women Engineers in the construction project in Banda Aceh

Note: T1: mismatch between educational background and job; T2: lack of interest in the construction project; T3: lack of training and practical work guidance; T4: lack of successful women career role models; T5: lack of technical skills; T6: societal culture and perceptions; T7: perception of work–life balance; T8: socio-cultural norms and expectations; T9: inflexible working hours; T10: sexual discrimination; T11: experiencing sexual harassment; T12: being treated differently due to gender; T13: knowing others who experience discrimination; T14: low recruitment of women workers; T15: health issues; T16: physical capability of women; T17: work environment; T18: workplace relationships; T19: limited opportunities for self-development; T20: workload; T21: lack of visibility and recognition; T22: gender-based wage gap

Figure 2 below presents a thematic analysis visualization in the form of a hierarchy chart, displayed as boxes of varying sizes. These differences in size arise because, during the coding process in NVivo 14, each challenge theme had a significantly different number of references. The hierarchy chart shows that the most prominent challenge faced by women engineers on the construction project in Banda Aceh, as indicated by the largest box, is physical capability. The next-largest boxes reflect the lack of training and practical work guidance, as well as perceptions of work–life balance. Other relatively large boxes indicate themes such as lack of interest in the construction project, mismatch between educational background and job, and low recruitment of women workers. Medium-sized boxes represent challenges, including inflexible working hours, socio-cultural norms and expectations, and workplace relationships. Slightly smaller boxes reflect issues such as lack of successful women career role models, societal culture and perceptions, workload, and lack of technical skills, which are associated with environmental support and competency readiness. At a smaller scale, the chart includes themes such as being treated differently because of gender, a work environment that limits opportunities for self-development, and a lack of visibility and recognition. Finally,

the smallest boxes in the hierarchy chart represent challenges related to sexual discrimination, health issues, knowing others who experience discrimination, experiencing sexual harassment, and the gender-based wage gap.

5. Discussion

5.1. Dominance of Physical and Structural Barriers

The results indicate that women's physical capability is perceived as the most significant challenge, ranking first with the highest mean value. This aligns with prior research highlighting the construction project's long-standing association with physical strength and manual labor, which often leads to gender-based assumptions about women's capabilities (Aulin & Jingmond, 2011; Patel & Pitroda, 2016). Such perceptions contribute to the marginalization of women and reinforce occupational segregation within the industry. However, this finding also reflects a persistent stereotype, as contemporary construction practices increasingly rely on technology and management skills rather than purely physical labor (Al Salaheen et al., 2024).

In addition, lack of training and practical work guidance emerged as a key challenge. This finding is consistent with studies emphasizing limited access to mentorship and skill development opportunities for women in construction (Wells et al., 2025; Saksena et al., 2020). The absence of structured training pathways may hinder women engineers' ability to gain confidence and technical competence, ultimately affecting their career progression. Furthermore, the issue of mismatch between educational background and job suggests inefficiencies in the transition from education to employment, supporting earlier findings that highlight the disconnect between academic preparation and industry demands (Moore, 2006; Graham, 1997). Another critical structural issue identified is the low recruitment of women workers, which reinforces gender imbalance in the industry. This finding aligns with global evidence indicating that women remain underrepresented in construction due to biased hiring practices and limited opportunities (Clarke et al., 2005; Seidu et al., 2022). The persistence of such barriers suggests that institutional mechanisms for promoting gender inclusion remain insufficient.

5.2. Work–Life Balance and Organizational Constraints

The study also identifies work–life balance as a major challenge, reflecting the difficulty of balancing professional responsibilities with personal and family roles. This is consistent with previous research highlighting that long working hours and demanding schedules in construction disproportionately affect women (Kumar & Chaturvedi, 2018; Rosa et al., 2017). The presence of inflexible working hours further reinforces this issue, indicating that organizational structures are not yet fully supportive of diverse workforce needs. Moreover, workload and limited opportunities for self-development were identified as moderate to low challenges, suggesting that while these issues exist, they may not be as critical as structural barriers. However, these factors continue to shape career trajectories and should not be overlooked, as they can cumulatively affect job satisfaction and retention (Saksena et al., 2020).

5.3. Socio-Cultural Influences and Gender Norms

Socio-cultural factors, including norms and expectations, societal perceptions, and a lack of women role models, also emerged as important challenges. These findings support previous studies that emphasize the influence of gender stereotypes and cultural expectations on women's participation in construction (Vijayaragunathan & Rasanthi, 2019; Akinlolu & Haupt, 2020). In particular, the limited visibility of successful women professionals may reduce motivation and confidence among aspiring women engineers, reinforcing a cycle of underrepresentation. Interestingly, while gender discrimination, sexual harassment, and wage gaps were identified as challenges, they were categorized at lower levels in this study. This contrasts with findings from other contexts where such issues are reported as significant barriers (Wang et al., 2021; Salama & Widaningsih, 2022). One possible explanation is that respondents may perceive structural and cultural barriers as more immediate and tangible than discrimination, or that there is underreporting due to social sensitivity surrounding these issues. This highlights the importance of considering contextual and cultural factors when interpreting gender-related challenges.

5.4. Thematic Synthesis of Challenges

The thematic analysis further supports the quantitative findings by illustrating the relative prominence of different challenges. The largest themes were physical capability, lack of training, and work–life balance, confirming the central role of structural and capacity-related barriers. Medium-sized themes, such as socio-cultural norms, workplace relationships, and lack of role models, emphasize the importance of social and organizational environments. Meanwhile, smaller themes related to discrimination and harassment,

although less frequently mentioned, still indicate underlying issues that require attention. This layered pattern of challenges suggests that women engineers' experiences are shaped by the interaction of multiple factors rather than a single dominant issue. It also highlights the need for a holistic approach to addressing gender inequality in the construction project.

The findings of this study have several important implications. First, we need to challenge stereotypes about physical capability by promoting awareness of technological advancements and the diverse skill requirements of modern construction. Second, improving access to training, mentorship, and professional development programs is essential to enhancing women's competencies and confidence. Third, organizations should adopt flexible work arrangements and supportive policies to address work–life balance issues. Furthermore, increasing the visibility of women role models and strengthening institutional support systems can help create a more inclusive environment. Policy interventions at both organizational and governmental levels are also necessary to address recruitment disparities and promote gender equality (Clarke et al., 2005; Wright, 2014)..

6. Conclusions

This study examined the challenges faced by women engineers on a construction project in Banda Aceh using a mixed-methods approach. The findings reveal that the challenges experienced by women engineers are complex and multidimensional, encompassing physical, structural, organizational, and socio-cultural dimensions. The most prominent challenges identified include perceived physical limitations, lack of training and practical guidance, work–life balance issues, low recruitment of women workers, and mismatches between education and employment. These challenges are further reinforced by socio-cultural norms, limited role models, and organizational constraints, which collectively shape women's participation and career development in the construction sector. The thematic analysis supports these findings by demonstrating that structural and capacity-related challenges are the most dominant, followed by socio-cultural and workplace-related issues. Although factors such as discrimination, harassment, and wage gaps were reported at lower levels, their presence still indicates underlying gender inequalities that should not be overlooked. The study highlights that women engineers in Banda Aceh navigate a combination of visible and subtle barriers, which influence both their entry into and progression within the construction project.

6.1. Research Implications

This study offers several important implications for both theory and practice. From a theoretical perspective, it contributes to the literature on gender and construction by providing context-specific insights from Banda Aceh, highlighting the importance of integrating local socio-cultural dynamics into the analysis of women's challenges. The use of a mixed-methods approach, particularly the incorporation of thematic analysis, enriches the understanding of women's lived experiences beyond purely quantitative findings. From a practical perspective, the findings suggest the need for policy and organizational interventions to improve gender inclusivity in the construction project. These include enhancing access to training and mentorship programs, promoting flexible working arrangements, and increasing the visibility of successful women role models. Additionally, stakeholders such as government agencies, educational institutions, and construction firms should collaborate to address recruitment disparities and support women's career development in the sector.

6.2. Limitations of the Study

Despite its contributions, this study has several limitations. First, the research is geographically limited to Banda Aceh, which may restrict the generalizability of the findings to other regions with different socio-cultural and economic contexts. Second, the sample consists primarily of early-career women engineers, which may not fully capture the experiences of women at more advanced career stages or in leadership positions. Third, the use of self-reported data through questionnaires may introduce response bias, particularly for sensitive issues such as discrimination and harassment. This reliance on self-reported measures may also lead to social desirability bias, in which respondents tend to provide answers perceived as socially acceptable rather than accurately reflecting their actual experiences. Additionally, while the Guttman scale provides clear, consistent responses, its dichotomous nature may limit depth and overlook nuanced perspectives. This measurement approach may constrain response variability and limit the ability to capture complex attitudes, thereby representing a methodological limitation for fully exploring participants' lived experiences. Furthermore, the study relies on a cross-sectional design, which limits the ability to capture changes over time or establish causal relationships between variables. Future studies employing longitudinal or mixed measurement approaches could provide deeper insights and improve methodological robustness. Although some of these limitations are partially addressed through qualitative data, further methodological refinement could enhance the richness and validity of future studies.

6.3. Future Research

Future research is recommended to expand both the scope and depth of investigation in this field. Comparative studies across different regions or countries could provide a broader understanding of how cultural and institutional factors influence women engineers' challenges in construction. Longitudinal studies are also needed to examine how women's experiences evolve over time, particularly in relation to career progression and leadership opportunities. Moreover, future studies could examine the roles of organizational policies, technological advancements, and Industry 4.0 in reducing gender barriers in the construction sector. Incorporating perspectives from men colleagues, employers, and policymakers may also provide a more comprehensive understanding of systemic challenges and potential solutions. Finally, the use of more advanced qualitative methods, such as in-depth interviews or case studies, could offer deeper insights into the lived experiences of women engineers.

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