ŌTAUTAHI CHRISTCHURCH AOTEAROA NEW ZEALAND
35TH AUSTRALASIAN ASSOCIATION FOR ENGINEERING EDUCATION ANNUAL CONFERENCE
8-11 DEC 2024
THE ENGINEER AND THE WORLD

Exploring Civil Engineering Cultures: A Study of Women's Experiences and Barriers to Change in the Construction Industry

Carrie Armstrong, Claudia Thompson, Nicoleta Maynard, Callum Kimpton, Alexa Delbosc
Monash University, Victoria, Australia
Corresponding Author Email: carm0005@student.monash.edu

CONTEXT

Construction is one of Australia's largest industries but has the lowest representation of women of any industry in Australia. Research has consistently identified the challenges women engineers face in construction, including long and inflexible work hours, gendered social norms, and negative perceptions of women's abilities. However, progress towards the employment and retention of women engineers remains slow. Evaluating the barriers to progress towards gender inclusion is a key aspect that must be understood if improvement is to be made in this area.

PURPOSE OR GOAL

This project aims to investigate gender inclusion within the engineering and construction industries, focusing on identifying challenges, barriers, and effective strategies for improving the recruitment, retention and professional environment for women engineers. We will explore gender-related challenges within engineering, evaluate the barriers to achieving gender inclusion among engineers, and identify actionable changes for primary contractors and engineering firms to implement to improve gender inclusion in the construction industry.

APPROACH OR METHODOLOGY/METHODS

This exploratory investigation takes a qualitative interpretivist approach. A literature review was conducted to establish what factors contribute to the low employment and retention of women engineers in construction. This was followed by interviews with primarily engineers at various levels to explore their interactions and perceptions of women in the field. Initial qualitative thematic analysis of three interviews provided an understanding of the barriers to change towards gender inclusion, with detailed thematic analysis of the remaining interviews still to be completed.

ACTUAL OR ANTICIPATED OUTCOMES

This study highlights two key themes relating to people being set in their ways, and attitudes that put responsibility for inclusion solely onto women. We anticipate the remaining interviews will discover a varying awareness across genders of the challenges facing women as construction engineers alongside other barriers to change towards inclusion.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

This study presents preliminary results of key factors that make the construction industry resistant to true gender inclusion. Identification of these barriers enables universities to target development of inclusive skills in graduates. It also provides government and industry insight to the implementation of policies and inclusion strategies that effectively overcome these barriers.

KEYWORDS
Industry Project, Equality Diversity and Inclusion, Women in Engineering

Introduction

It is well known that construction is a challenging workplace for women of all professions, including engineers (Naoum et al., 2020). Women's participation in Australia's construction industry reduced by six percent from 2006 to 2020 to 11% (Holdsworth et al., 2023). Despite an increase to 18.5% in 2022, construction still has the lowest representation of women of any industry in Australia (Australian Bureau of Statistics [ABS], 2022). It is important to note that many of the roles of women in construction are secretarial and administrative (Naoum et al., 2020). The participation of women as engineers is much lower, with Engineers Australia (2022) reporting 13% of the overall engineering workforce in Australia being female.

This research examines the intersection of civil engineers working for construction contractors, which are therefore referred to as construction engineers. However, existing literature primarily focuses on the experience of women in construction and engineering as separate areas of study, with particular emphasis on the barriers to retain women within the industry. Common issues highlighted by Ghanbaripour et al. (2023) are work hours and family, gendered culture and informal rules, career opportunities and available roles, and perception of women's abilities. The work hours are considered long and inflexible (Male et al., 2018; Naoum et al., 2020), which are not compatible with the expectations of caring responsibilities largely fulfilled by women (Male et al., 2018). The culture shames leaving work on time (Chappell & Galea, 2016), excludes women from social interaction (Holdsworth et al, 2023), and forces women to adhere to feminine typecasts (Beddoes, 2022). The linear career progression (Sunindijo & Kamardeen, 2017), and the gender bias in recruitment (Shantz et al., 2011) inhibits many women from growth opportunities in their career. Furthermore, the presumption that women are incapable until otherwise proven (Turner et al., 2021) acts as a barrier to retaining women. Moreover, issues such as personal protective equipment (PPE) not fitting (Male et al., 2018) and sexual harassment and bullying (Baker et al., 2024; Sunindijo & Kamardeen, 2017) are also significant. These issues have been consistently present across three decades of research (Janis & Mertens, 2001; Khazanet, 1996; Yates, 1992). Current research also highlights the resistive behaviours preventing change in the construction industry (Koskela et al., n.d.; Lines et al., 2015), however studies have not adequately explored what barriers exist to change toward gender inclusion in construction engineering.

Construction is the sixth largest industry in Australia with major infrastructure pipelines outstripping the industry's capacity to deliver (ABS, 2022). Victoria is spending over A$78.5 billion on infrastructure, or 20% of the 2023-24 budget, to be delivered by an industry with less than 20% women employed (Infrastructure Partnerships Australia, 2023). With worker shortages, the industry is looking for ways to encourage the employment of women to expand the workforce. Additionally, there is a moral imperative for government to be leading gender, equality, diversity, and inclusion (GEDI) efforts and ensuring ethical practices where taxpayer money is being spent. To ensure these goals can be met, the barriers to change within the industry should be identified to ensure approaches to gender inclusion are targeted and effective. Thus, our aim is to identify the challenges and barriers hampering the advancement of gender inclusion within the construction industry.

Research Objectives

Research Question

What barriers hinder the progress towards gender inclusion of women civil engineers in the Australian construction industry?

Aims and Objectives

The study aims to explore gender inclusion within the engineering construction industry focusing on identifying the challenges, barriers, and potential effective strategies to improve the recruitment, retention, and professional environment for women engineers.

The objectives are as follows:

1. To conduct an extensive literature review to assess the landscape of gender-related challenges within engineering and construction sectors.
2. To evaluate the barriers to achieving gender inclusion among engineers in the construction industry by conducting semi-structured interviews with engineers and management staff from construction contracting firms.

Literature Review

Existing literature identifies numerous challenges faced by women in engineering and construction sectors. These experiences are relatively uniform for women in both construction and engineering (Ghanbaripour et al., 2023) (Male et al., 2018). Most of these challenges fall under the themes identified in Ghanbaripour et al. (2023); work hours and family, gendered culture and informal rules, career opportunities and available roles, and perception of women's ability.

The long hours of site-based engineering, the implications of taking parental leave, and the care responsibilities outside of the workplace can prevent women's full and equal participation in construction engineering. However, the assumption that women tend to leave their roles due to their parental responsibility is opposed by Beddoes (2022). Although, work-life balance was found to influence retention of women positively (Malone & Issa, 2014), flexible hours and work from home arrangements can introduce greater strain on work-life balance for all employees, but especially for women due to greater care responsibilities in the home (Pirzadeh & Lingard, 2021). Furthermore, Maher and Denver (2004, p. 16) identified that "supportive attitudes" are critical to how women experience family policy implementation. The assumption that prioritising work-life balance is intrinsically linked to reproductive planning for women is countered by Maher and Denver (2004). Therefore, work-life balance may need to be addressed by cultural change as well as policy change for the retention of all women not just women with or planning for children.

Gendered culture and informal rules are expressed through a culture of "shaming" employees who attempt to generate work-life balance (Chappell & Galea, 2016). This substantiates an informal culture of "presenteeism" in which employees feel compelled to be constantly at work even when not productive (Chappell & Galea, 2016). Additionally, the alterations of male behaviour when in the presence of a woman, such as apologising for swearing, segregates women from connecting with their colleagues (Male et al., 2018). The isolation of women is furthered by a dominant culture causing men to fear standing up to perpetrators and risk being excluded (Holdsworth et al., 2023). Furthermore, women are often excluded from social activities among colleagues such as going to the pub or golf, which reinforces this isolation (Holdsworth et al., 2023).

The gendered culture is also seen through the impact of femininity on professional success in the industry (Beddoes, 2022). Unlike men, women must be liked in order to be influential and promoted, this involves adhering with feminine typecasts, they must not be assertive or direct (Beddoes, 2022). Moreover, when women do not sound "girly", "chipper", and "bubbly", they can be criticised and questioned (Beddoes, 2022, p. 108-109). Despite this, men do not recognise the advantage within the workplace due to their gender, they consider their success due to happenstance (Beddoes, 2022). Moreover, men consider being a woman a form of positive discrimination professionally (Naoum et al., 2020). However, women tend to have less opportunities within their work and are usually one hierarchical level below male counterparts of same experience and age (Naoum et al., 2020).

Career opportunities and available roles for women are impacted by the traditionally linear approach to career progression by preferencing men, as women are often unwilling to conform to this model or unable to due to parenting responsibilities (Sunindijo & Kamardeen, 2017). The construction industry's hiring practices that rely on personal networks tend to recruit people who "resemble [the] current workforce" (Shantz et al., 2011, p. 221) and perpetuate gender bias in recruitment. Additionally, recruitment agencies can also uphold gender bias through placing

potential employees in “sex-typical occupations” (Shantz et al., 2011, p. 221). Zhang et al. (2021) identified that women are also overlooked with regards to contracts, projects, and promotions as they reach “childbearing years” (p. 679).

Regarding the perception of women’s abilities, Male et al. (2018) note that, for women, the professional identity as an engineer is commonly diminished, even after correcting a perpetrator. This is as women’s capability is open to scrutiny, however, men are presumed to be capable (Turner et al., 2021). Zhang et al. (2021) illustrates how the undermining of women’s abilities can occur through men preferencing the expertise of other men by not addressing women in work meetings or conversations.

These four categories are not a comprehensive exploration of women’s experiences in the industry. Male et al. (2018) also highlighted personal protective equipment (PPE) commonly being unsuitable for women introducing gendered safety risks. Sexual harassment remains an ongoing issue (Leaper & Starr, 2019), as does gendered experiences of stress in the construction industry (Sunindijo & Kamardeen, 2017). While the top stressors of workload, long hours, time pressures, and an unpleasant environment are common across genders, women endure more stress due to discrimination, sexual harassment, and bullying (Sunindijo & Kamardeen, 2017). Yates (1992) identifies perception of women’s abilities being unnecessarily questioned. Themes of isolation, harassment, and having to work harder were all identified (Yates, 1992). Khazanet (1996) highlighted the challenge of work hours and family through flexibility as the key issue in retaining women within civil engineering, particularly as women were the primary caregiver for young children. As has been demonstrated, literature over more than three decades demonstrates consistent and generally well researched experiences of women in the industry.

Approaches to change in construction towards gender inclusion have also been researched, however, to a lesser degree. Koskela et al. (n.d.) attributes the slow social progression to the narrow insight available into the change needed and how to successfully implement change. While Lines et al. (2015) identify many resistive behaviour types in construction organisations which can be overcome by assigning accountability for execution of change. Loosemore et al. (2022) adds to this suggesting that all employees must see the change as their responsibility. Differently, more socially sustainable workplaces are characterised by transformational leadership styles which empower and inspire the workforce (Afzal & Tumpa, 2024) as well as “The Clan” culture which is based on teamwork, openness, and discussion (Derbidge, 2018; Rameezdeen & Gunarathna, 2016). Instead, Sunindijo & Kamardeen (2017) indicate that due to industry competition, social trailblazing would be detrimental to the businesses’ survival. When comparing construction engineering to other previously male-dominated fields such as medicine and law, the interactions with consumers who are women and families provides a catalyst for change (Male et al., 2018). While existing research provides substantial insight into the challenges faced by women in achieving inclusion, there remains a significant gap in understanding the specific barriers that are impeding progress toward gender inclusion.

Methodology and Methods

A qualitative approach has been adopted comprising of a series of in depth semi-structured interviews. Semi-structured interviews have been chosen to elicit qualitative data describing the reasons why and how change hasn’t been successful in the industry. This enables specific exploration of what barriers exists to implementing gender inclusion in construction engineering, and how these barriers interact with the previously identified challenges women face.

This investigation takes a qualitative interpretivist position of social constructionism widely adopted in social science epistemologies and gender studies (Baillie & Douglas, 2014). We maintain that the role of gender and how it is experienced in the workplace is negotiated by all parties and can be held to be different for different individuals (Baillie & Douglas, 2014). As such, we must adopt “methods of inquiry” that allow us to “explore experiences and perceptions” (Baillie & Douglas, 2014, p. 3). It is therefore necessary to select research methodologies which promote exploration of the experiences and perceptions of participants (Baillie & Douglas, 2014) regarding

the factors which prove the construction industry resistant to implementing effective gender inclusion, recruitment, and retention initiatives. Overwhelmingly, these epistemologies and methodologies lend themselves to qualitative research methods in the form of semi-structured interviews (Borrego et al., 2009).

The methodology also leans on some understanding of discourse analysis as many attitudes towards and perceptions of gender can be observed in communication in addition to the conscious reflections of the participant (Baillie & Douglas, 2014). However, phenomenography and critical thematic analysis are more central to the research design (Baillie & Douglas, 2014). The experiences and reflections of construction engineers, even as they are formed through interactions within their specific contexts, provide significant insight into the key factors addressing change in the industry. Phenomenography and thematic analysis allow for the identification of common and varied understandings of the factors which cause resistance to implementing effective gender inclusion initiatives in construction engineering.

Qualitative research methods are “characterised by the collection and analysis of textual data” and by an “emphasis on the context within which the study occurs” (Borrego et al 2009, p. 55-56). Borrego et al. (2009), among others (Baillie & Douglas, 2014; Tracy, 2010), emphasise that each method, qualitative, quantitative, or mixed methods, must be chosen according to its suitability to achieve the research aims and objectives. Qualitative research also typically focusses on a small sample size in order to gain a deep understanding of a specific context (Borrego et al., 2009). Subsequently, this study diverges from a typical engineering approach of requiring statistically significant, quantitative data to demonstrate validity of the study (Baillie & Douglas, 2014).

Full research ethics approval was obtained from the Monash University Human Research Ethics Committee before any interviews were conducted. Participants were identified through personal contacts (purposeful sampling) of the researchers and snowballing from participants and were approached via email or phone call. Participants were provided with an explanatory statement, consent form and recruitment document where they could elect to participate in the research, including information detailing the de-identification of all data. Interviews were guided by a loose interview guide over approximately 60 minutes, through video calls or in person as the participant preferred. However, both the participants and researchers were free to direct the conversation to relevant topics to gain a detailed understanding of unanticipated avenues of enquiry. Interviews were recorded and transcribed using Zoom or Microsoft Teams, transcriptions were reviewed for accuracy and thematically analysed. Thematic analysis involved a reflexive approach following the 6-phase guide presented in Braun and Clarke (2006).

At the time of writing, the study is a work in progress yet not complete. Consequently, the analysis presented in this paper was drawn from three strategically selected interviews which had been conducted. Key to producing meaningful qualitative research is ensuring the credibility, transferability, and reliability of the study (Tracy, 2010). In our research this is achieved through a foundation in existing research, sampling until saturation, and the purposive selection of interview participants to ensure a range of gender and experience is represented (Bakhary, 2023). Thick descriptions, inclusion of all relevant context in analysis, and explanations of coding of themes during analysis also contributes to the credibility and reliability of the study (Borrego et al., 2009).

Findings and Discussion

The findings detailed in this paper are a summary of a selection of three interviews completed at the time of writing. Specifically, the participants include a male Project Director (PD), a female Construction Manager (CM), and a female General Manager of Health, Safety, Environment, and Quality (GM HSEQ) who reports to the executive leadership team (ELT) of her company. All three of these participants currently work for national construction engineering companies operating in Australia. However, only the PD and CM have an engineering background, while the GM HESQ has extensive experience with engineers in construction.

During the thematic analysis, two barriers that are fundamental to bringing about change in construction engineering were identified. The first barrier to change is an attitude that inclusion of

women is a ‘women’s issue’ that only affects women and is subsequently the responsibility of women to address. The final barrier identified was a broadly held understanding that people in the industry are set in their ways.

It’s a Women’s Issue

Despite much support for gender inclusion, there are still strong tones that exclusionary factors only affect women and is even more pronounced for women who are seen as mothers or caretakers. The PD commented on the topic of flexibility and work life balance: “I’m more aligned to where women think because I’ve got kids”. This thinking places boundaries on the discrimination felt by women engineers based only on the caring responsibilities of motherhood, regardless of their parental status. Another participant commented “if you’re a woman with childcare demands… I think the industry as a whole needs to change [to see how] that could be a male or female issue”. The third participant extended this idea saying, “we know that we have one of the highest burnout rates of any other industry. We know that we have one of the highest suicide rates of any other industry. We know all this and we know that fatigue plays a massive role in it”. She emphasised “yes, we need to fix that, but we need to fix that for our industry not to get more females into it… but I think it’s more a mental health well-being for our industry as a whole”. Flexibility has long been identified as a key strategy to increase the participation of women in engineering (Malone & Issa, 2014). However, exclusively seeing this as important to increase the participation of mothers, and therefore all women, in the industry perpetuates the idea that men and women should be treated differently and given different opportunities in the workplace.

Furthermore, in addressing exclusionary factors which are perceived as only impacting women, much of the attention has been focussed on women. When asked about what strategies are in place to support women engineers, all participants spoke of training opportunities for women. One participant emphasised the need to “keep giving [women] that more technical experience as well so that they can continue to grow”. However, others spoke to the current reality of “programs just specifically for women emerging leaders” and how “women are putting so much extra time, so much extra effort, doing extra-curricular stuff to develop themselves”. While these programs are certainly helping increase the capability of women in the industry, one participant expressed concern that “unless we’re developing the [men] with all these tools, we're never gonna change [leadership]”. As this participant notes, while the leadership remains majority men and the strategies towards inclusion are focussed primarily on women “we will still have [men] coming up in [leadership] positions with no education and no stuff along the way to make them a better leader and ultimately lead the team of people better”. Together, these concepts form a substantial barrier to change towards inclusion. Without recognising that these issues are issues for everyone and therefore should be addressed by everyone, strategies for inclusion may too easily bypass decision makers, both men and women, and continue to see isolated or limited success.

People Are Set In Their Ways

A theme that was raised consistently across the interviews was that those in the construction industry are set in their ways. The PD explained that people within the industry tend to “keep on doing the same thing” as it is the “path of least resistance”. The CM furthered this, stating “the way we do things I think is kind of fundamentally wrong”. These statements represent beliefs about the industry being inherently inflexible and unadaptable. There is a large degree of acceptance that some things are “fundamental” or intrinsic in the industry and thus can’t be changed. This is embodied in statements such as “it’s just the nature of the industry”, “it all comes down to time and cost”, “it’s the way we’ve always done it” and even “I did the hours, so you do the hours”. However, as one participant observed, the balance of time and cost is being “actively challenged” by proposals for a five-day work week to support a greater work-life balance.

Emphasis on work-life balance conflicts with continual occupations run to minimise infrastructure closures and subsequent impacts to communities. The “high public engagement” noted by the GM HSEQ of major projects sees clients unwavering in setting tight programs. As the industry is “quite reactive”, this forces the construction to occur almost entirely “after hours”, and “without

shutting … down” infrastructure. Hence, the unwillingness to reevaluate a project’s priorities to consider welfare of employees above disrupting and angering the community. This reluctance to create an environment which facilitates flexible work hours is a significant barrier to retaining women (Malone & Issa, 2014).

A similar opposition to enacting change is noted by both CM and GM HSEQ who see a necessity for government targets to increase the participation of women engineers in construction. They identify that “if you don’t measure it, it’s not going to get done”. This belief that companies can only improve inclusion of women when there is a “legal requirement for you to do it”, indicates that the industry is fearful of trailblazing and setting their own targets. Without an imposed imperative to change, the industry has not successfully championed the necessary progress.

This extends past contractual elements of a project and into human resourcing. The GM HSEQ described the attitude of operations leaders and HR towards openly discussing succession planning to promote women into senior roles as a “fear that it’s almost discriminatory” and that “people will be offended, and it won’t be seen as a fair process”. Evidently, personal priorities also influence decisions being made around inclusion strategies for women in construction engineering. Reinforcing this idea, the GM HSEQ comments on the hesitancy of men to promote women into leadership roles as they’ve “seen it fail because we promote them too early” despite the same being true of men in leadership positions. However, the visibility of women in leadership requires a higher assurance of success for decision makers, typically men, to be comfortable with the perceived ‘risk’ of promoting women.

In discussing promotion of women and early succession planning to target women’s development, the GM HSEQ attributed the difficulty in promoting women due to the statistically low participation of women saying “[women] are just not present”. However, strategies all participants identified as overcoming this often accepted that the process in challenging these norms may be uncomfortable but is necessary to establish a new norm that is much more inclusive for all people. The appetite to challenge these norms relies on an acceptable risk profile from the industry. The ability for a contractor or client to openly and aggressively pursue gender inclusive practices must first overcome the inertia of people being set in their ways and support creative and disruptive solutions. Ultimately, change cannot be implemented without disrupting the status quo but without change, construction engineering will not see true gender inclusion.

Recommendations and Limitations

Although saturation has not been reached in this study, the findings could be more robustly supported with a larger sample size, which would allow for saturation to be achieved. Additional interviews are currently being conducted and will be presented in future publications. Furthermore, this methodology could be expanded by incorporating a quantitative phase following the interviews serving as an exploratory design to identify the most significant barriers to gender inclusion in the Australian construction industry.

This study determined two key areas that government, contractors and leaders in the construction industry must address in order to make meaningful change to improve the construction engineering workplace for women. Organisations should critically assess determinations of risk in commercial and resourcing decisions with greater emphasis on the reward brought by diversity in the workplace. The exclusionary factors need to be understood as problematic for everyone in a workplace and subsequently addressed by men and women, particularly as majority of the workforce and leadership to a greater extent are men. Investing only in the development of women in leadership does not address the responsibility that men have to support inclusive practices in order to affect change in the industry. Finally, understanding that people can be comfortable with how things have been done in the past and therefore resistant change can drive clients and contractors to incentivise innovative solutions. While industry does broadly understand the challenges women face in construction engineering, deepening the understanding of what barriers must be overcome before change can be effectively implemented is critical to beginning to move the scales towards gender inclusion.

References

Australian Bureau of Statistics. (2022, August 11). Characteristics spotlight: 2022. ABS. https://www.abs.gov.au/articles/characteristics-spotlight-2022.

Afzal, F. & Tumpa, R. J. (2024). Exploring Leadership Styles to Foster Sustainability in Construction Projects: A Systematic Literature Review. *Sustainability, 16*(3). https://doi.org/10.3390/su16030971

Baillie, C., & Douglas, E. P. (2014). Confusions and Conventions: Qualitative Research in Engineering Education. *Journal of Engineering Education (Washington, D.C.), 103(*1), 1–7. https://doi.org/10.1002/jee.20031

Baker, M., Ali, M., Crawford, L. (2024). What do women want? An exploration of workplace attraction and retention factors for women in construction. *International Journal of Construction Management, 24*(3), 270-280. https://doi.org/10.1080/15623599.2023.2222987

Bakhary, N. A. (2023). *Semi-Structured Interview of Industry 4.0 for SMEs in the Malaysian Construction Industry*. European Conference on Research Methodology for Business and Management Studies*, 22*(1), 9–17. https://doi.org/10.34190/ecrm.22.1.1290

Beddoes, K. (2022). Gender as structure in the organisational socialisation of newcomer civil engineers. *European Journal of Engineering Education, 47*(1), 102-116, https://doi.org/10.1080/03043797.2021.1915251

Borrego, M., Douglas, E. P., & Amelink, C. T. (2009). Quantitative, Qualitative, and Mixed Research Methods in Engineering Education. *Journal of Engineering Education (Washington, D.C.), 98*(1), 53–66. https://doi.org/10.1002/j.2168-9830.2009.tb01005.x

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Chappell, L., & Galea, N. (2016, December 6). Construction is the last frontier for women at work. https://www.smh.com.au/opinion/construction-is-the-last-frontier-for-women-at-work-20161206-gt4par.html

Derbidge, A. (2018, November 19). Women in Engineering: The women have their say.... LinkedIn. https://www.linkedin.com/pulse/women-engineering-have-say-andrew-derbidge

Engineers Australia. (2022). Women in Engineering. https://www.engineersaustralia.org.au/sites/default/files/2022-07/women-in-engineering-report-june-2022.pdf

Ghanbaripour, A. N., Tumpa, R. J., Sunindijo, R. Y., Zhang, W., Yousefian, P., Camozzi, R. N., Hon, C., Talebian, N., Liu, T., & Hemmati, M. (2023). Retention over Attraction: A Review of Women's Experiences in the Australian Construction Industry; Challenges and Solutions. *Buildings (Basel), 13*(2), 1-19. https://doi.org/10.3390/buildings13020490

Holdsworth, S., Turner, M., Sandri, O. (2023). Gender Bias in the Australian Construction Industry: Women's Experience in Trades and Semi-Skilled Roles. *Social Sciences, 12*(11). https://doi.org/10.3390/socsci12110627

Infrastructure Partnerships Australia. (2023). Australian Infrastructure Budget Monitor 2023-24. https://infrastructure.org.au/wp-content/uploads/2023/12/Australian-Infrastructure-Budget-Monitor-2023-24-1.pdf

Janis, L., & Mertens, E. (2001). Women in construction. Construction in cities.

Khazanet, V. L. (1996). Women in Civil Engineering and Science: It's Time for Recognition and Promotion. *Journal of Professional Issues in Engineering Education and Practice, 122*(2), 65-68

Koskela, L., Ballard, G., & Howell, G. (n.d.). Achieving Change in Construction. https://www.researchgate.net/publication/267968867_ACHIEVING_CHANGE_IN_CONSTRUCTION

Leaper, C., & Starr, C. R. (2019). Helping and Hindering Undergraduate Women's STEM Motivation: Experiences With STEM Encouragement, STEM-Related Gender Bias, and Sexual Harassment. *Psychology of Women Quarterly, 43*(2), 165–183. https://doi.org/10.1177/0361684318806302

Lines, B. C., Sullivan, K. T., Smithwick, J. B., & Mischung, J. (2015). Overcoming resistance to change in engineering and Construction: Change Management Factors for owner organizations. *International Journal of Project Management, 33*(5), 1170–1179. https://doi.org/10.1016/j.ijproman.2015.01.008

Loosemore, M., Keast, R., & Barraket, J. (2022). A typology of social procurement champions in the construction and engineering industry. *Construction Management and Economics, 40*(5), 391-405. https://doi.org/10.1080/01446193.2022.2043554

Maher, J., & Dever, M. (2004). What matters to women: beyond reproductive stereotypes. *People and Place (Clayton), 12*(3), 10-17.

Male, S. A., Gardner, A., Figueroa, E., & Bennett, D. (2018). Investigation of students' experiences of gendered cultures in engineering workplaces. *European Journal of Engineering Education, 43*(3), Article 3.

Malone, E. K., & Issa, R. R. A. (2014). Predictive Models for Work-Life Balance and Organizational Commitment of Women in the U.S. Construction Industry. *Journal of Construction Engineering and Management, 140*(3). https://doi.org/10.1061/(ASCE)CO.1943-7862.0000809

Naoum, SG., Harris, J., Rizzuto, J., Egbu, C. (2020). Gender in the construction industry: literature review and comparative survey of men's and women's perceptions in UK construction consultancies. *J Manage Eng, 36*(2). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000731.

Rameezdeen, R., & Gunarathna, N. (2016). Comparison of cultures in consultant and contractor organizations in construction industry. *Built-Environment Sri Lanka, 3*(2), 59-66. https://doi.org/10.4038/besl.v3i2.7642

Pirzadeh, P., & Lingard, H. (2021). Working from Home during the COVID-19 Pandemic: Health and Well-Being of Project-Based Construction Workers. *Journal of Construction Engineering and Management, 147*(6). https://doi.org/10.1061/(ASCE)CO.1943-7862.0002102

Shantz, A., Wright, K., & Latham, G. (2011). Networking with boundary spanners: A quasi-case study on why women are less likely to be offered an engineering role. *Equality, Diversity and Inclusion: An International Journal, 30*(3), 217–232. https://doi.org/10.1108/02610151111124950

Sunindijo, R. Y., & Kamardeen, I. (2017). Work stress is a threat to gender diversity in the construction industry. *Journal of Construction Engineering and Management, 143*(10). https://doi.org/10.1061/(asce)co.1943-7862.0001387

Tracy, S. J. (2010). Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research. *Qualitative Inquiry, 16*(10), 837–851. https://doi.org/10.1177/1077800410383121

Turner, M., Holdsworth, S., Scott-Young, C. M., & Sandri, K. (2021). Resilience in a hostile workplace: the experience of women onsite in construction. *Construction Management and Economics, 39*(10), 839–852. https://doi.org/10.1080/01446193.2021.1981958

Yates, J. K. (1992). Women and Minorities in Construction and Engineering in the 1990s. American *Association of Cost Engineers International Journal, 34*(6), 9-12.

Zhang, R. P., Holdsworth, S., Turner, M., & Andamon, M. M. (2021). Does gender really matter? A closer look at early career women in construction. *Construction Management and Economics, 39*(8), 669–686. https://doi.org/10.1080/01446193.2021.1948087

Copyright statement