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Towards a Sustainable Construction Industry: A Fuzzy Synthetic Evaluation of Critical Barriers to Entry and the Retention of Women in the South African Construction Industry

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Abstract: Over the past few decades, numerous efforts have been made to increase the proportion of women in the construction industry, coupled with various calls for legislation and rules to prohibit gender discrimination. Despite these efforts, minimal progress has been noticed in the construction industry. While recruitment remains crucial, the current culture in construction reveals a knowledge gap in recruitment and retention in employment—a concept known as a 'leaky pipeline'. Lack of awareness of career options and the challenges of working in a male-dominated, occasionally discriminatory workplace are some of the significant barriers to attracting and keeping women in the construction industry. Much of the research in South Africa shows that most construction companies employed few women but only in lower secretarial and administrative positions. Therefore, this study investigated the barriers facing women's entry and retention in construction-related employment in South Africa using fuzzy synthetic evaluation (FSE) to understand and prioritise the barriers. Data were collected through the administration of online and paper-based questionnaires. The results of the analysis show that the barriers in the order of criticality include support and empowerment issues (SEs), educational/academic-related barriers (ABs), barriers from professional conditions and work attributes (BPs), social perception and gender stereotype barriers (SPs), professional perceptions and gender bias (PP), and individual confidence/interest/awareness/circumstance-related barriers (IBs), respectively. Based on the findings of the study, several recommendations, including on-the-job tutoring and flexible work arrangements, amongst others, were provided.

Keywords: construction industry; diversity; accessibility; equality; inclusivity; gender

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1. Introduction

Gender equality issues have been a part of progressive social trends in human development for many decades [1]. In recent times, several nations have shown uninterrupted attention to issues related to gender equality, linked to the Sustainable Development Goal 5 (SDG 5), provoking discourses at both the local and international scenes [2]. SDG 5 aims

to minimise gender disparities and develop a society that enables equity for the female gender, where both women and girls are given equal rights and opportunities in society. Equalising opportunity means applying the same conditions and rules to people in all aspects of life, including in the case of female workers in any sector [3]. SDG 5 accentuates the significance of weakening social beliefs and clichés that perpetuate gender inequality and address systemic barriers that relegate women in society [2].

Consequently, Harvey et al. [4] define gender equality as a state of "no difference" between the female and male gender concerning the various indicators of social and cultural rights. Gender inequalities are deeply entrenched in nations across the globe and permeate across all dimensions of sustainable development [5]. Bhat et al. [6] report that one in every seven countries struggles to achieve a quarter of the targeted SDG 5 indicators. The current forecasts reveal that 383 million females dwell in the utmost poverty. This requires immediate suitable action to advance and realise gender equality, which would deliver the 2030 agenda pledge for a better world, with a global consideration for human rights and dignity that thoroughly outlines and recognises women's potential [5].

Past studies on gender inequality, women's empowerment, and discrimination against women based on SDG 5 exist, yet women's representation in significant leadership positions and in government, decision-making, business, and community service roles continues to decline [7,8]. The proportion of women in senior and middle management remains below 50% globally, and less than a third of such positions are held by women [5]. Therefore, given the advancement of human civilisation, women's social and economic status in society ought to experience some positive transformation [1], but this is not the case yet in many industries, including the construction sector. To fill this gap, an investigation of the barriers to women's entry and retention should be explored in the construction industry to enable a visible change that accommodates gender equality.

Various authors have revealed that the construction industry is suffering from challenges related to diversity, equality, and inclusivity [1,9–11]. Therefore, gender equality presents opportunities for enhancing workforce diversity and inclusiveness and for reducing skill shortages. However, studies show that the construction industry is yet to be considered a fully inclusive, diverse, equitable, and accessible industry [12], especially for females, due to the existing structural prejudices and unconscious biases [10]. Therefore, investigating the barriers to women's entry and retention in construction-related careers is essential. Studies on women's entry and retention in the South African construction industry are also limited. Meanwhile, similar investigations in Egypt [13], Jordan [14], Pakistan [15], Chile [16], and Peru [17], among others, have been explored. This study prioritises the barriers facing women's entry and retention in the South African construction industry and provides recommendations and actionable stances. It is worthwhile noting that the post-apartheid experience, such as in racial disparities, politics-related issues, economic inequality, and social challenges, could also bring a unique context to occupation gender equality and retention in South Africa, as compared to the global situation [18,19]. Understanding the barriers facing women's entry and retention in the South African construction industry would shed light on the key hinderances facing women's professional advancement in the sector. The results of the study could provide a comparable set of the barriers facing women's entry and retention in other developing nations and the global construction market. In addition, the findings on the situation in the South African context would help provide practical recommendations to address barriers and encourage the involvement of women in the construction industry. Considering the population of developing nations, encouraging women's participation and retention in the construction industry is essential to enhance the diversity, inclusiveness, and equality in the global

construction market, as well as in contributing to a reduction in the skills shortage in the sector.

In other sections of this paper, a review of past studies on the barriers facing women's entry and retention in construction employment is conducted. The methodology employed to achieve the study's research objectives is extensively presented. The data retrieved from the respondents through online and paper-based questionnaires are analysed using fuzzy synthetic evaluation (FSE) and discussed with findings from past studies to draw practical implications and conclusions.

2. Literature Review

2.1. Overview of Construction Industry

Global researchers have widely claimed that the construction industry is one of the largest contributors to a country's GDP, with great employment opportunities [20]. Its economic importance to a nation's competitiveness and prosperity cannot be overemphasised [21]. The industry significantly contributes to a nation's economic growth, from small-scale projects to massive infrastructure projects impacting all levels of society. Therefore, the industry must be women-inclusive for the purpose of gender equality and to utilise untapped human resources. Women and girls account for half of the world's population, and thus half of the world's human potential [7]. So, if their lives are enhanced, the benefits trickle across society. However, the challenges in developing a diverse construction workforce are enormous, and the solutions are complex [22]. Subsequently, the industry, among others, struggles to conveniently accommodate women [9], which has become a global challenge that affects both developing and developed nations [1,23]. The involvement of women in the construction industry is low because of minimal employment for women in core construction activities [2,16], while some argue that the industry is naturally territorial, with profound reluctance in acceptance of women's skills [7].

2.2. Global Gender Equality Perspective in Construction Industry

Globally, the male-dominated nature of the construction industry is a topical issue in both the developed and developing world. In Europe, the propagation of gender equality is observed by enhancing the effectiveness of mainstream policies through the labour market, the feminist movement, politics, and governance [24]. Mun [25] reveals that women only make up 11% of those actively engaged in this sector. Even though some disparities in gender equality and female empowerment exist among the different EU countries, development is not similar across all European countries [1]. Germany reflects the smallest difference, followed by France and the United Kingdom, and the gender gap is smaller among young people than for the older generation [26]. In the UK construction sector, more than two-thirds of people of colour working in the industry have reported restrictions in their career progression due to their race, sexual orientation, or age [27]. In North America, a higher degree of acceptance and support for gender equality is observed, mainly in the United States [28]. Women in the US constitute one-tenth of the total construction workforce [29], even though 50.8% of the US population are females, and 21.9% of civil servants have been females over the last two decades [30]. In South America, the population is about 50% female, but a limited percentage of them are engaged in the construction industry workforce, as observed in Brazil (4.3%), Argentina (4.3%), Peru, (4.4%), Columbia (7.1%), and Chile (8.36%) [16,31,32]. Gender equality development in Australia and the Asia–Pacific region, such as in China, India, and Singapore, is hampered by traditional beliefs [1,33]. Research in South Africa has shown that male dominance in employment exists in the construction industry at all levels [2]. The post-apartheid South African society struggles with the societal patriarchal system, worsened by the prevailing apartheid laws

that promulgated the various Bantu Acts [34]. Male dominance in the construction sector persists unabated. The South African government implemented initiatives to encourage women's participation in the industry [35].

2.3. Barriers Facing Women in the Construction Industry

Although the construction industry is one of the largest employers of labour [23], most of its employees are men, with women accounting for 10.8% of the workforce in the United States construction industry [36]. Globally, approximately 3% and 12.3% of women are chief executive officers and managers in construction organisations [37], and 8.9% of construction workers in Europe are women [38]. The construction industry remains one of the most male-dominated sectors [12]. There is a significant barrier to women's construction entry, development, and retention [39]. Studies from densely populated countries like Pakistan, Nigeria, and India have shown that women's participation in the construction industry is about 50%, with women occupying unskilled helper positions [38,40,41]. Myriad of these challenges are exhibited in cultural and structural barriers, such as harassment, discrimination, limited work opportunities, and inflexible working hours [42,43].

Diversity management plans are one of the focuses of many AEC companies; however, women's representation in professional and managerial roles in the AEC industry remains low [30,44]. A study by Lingard and Lin [45] conducted in Australia found no significant difference in work–life experiences amongst men and women due to their work location (i.e., office and site-based). It is worth noting that domestic responsibility, which affects work–life balance, was a key challenge faced by women in the Australian construction industry during the pandemic [46]. On the other hand, Malone and Issa [47] found that flexibility and balance between work and personal time is a top-ranked factor affecting women's organisational commitment and desire to stay with their employers in the US construction industry. The barriers to women's leadership include unconscious bias, poor recruitment practices, and poor workplace cultures [48].

South Africa's construction industry has historically been male-dominated and clichéd as a physically demanding and dirty job, discouraging women from entry [49]. The physically demanding nature of the industry, limited tolerance, harsh working conditions and environment, harsh weather, and inappropriate language [42,50] are attributes which have been identified as discouraging women. However, studies have proven that this is not the case with proper training and support for women [51]. Studies suggest that traditional preconceived cultural and male-dominated attitudes and practices are stubborn and hard to change [38]. There is also an inaccurate misconception that engineering courses are meant for men, and this exacerbates the gender inequality scenario of some students in engineering jobs [52]. Other factors include career development paths, inadequate education, ineffective mentorship, the absence of strong networks, family interferences, and a lack of construction industry mentors [53].

Career success is considered a motivator for participation and job retention. However, work–family balance is often a huge challenge and is a key reason women leave the sector. Lingard and Lin [45] agree that higher work–family conflict levels are accompanied by organisational practices like inflexible work arrangements, inadequate supervisor support, and longer working hours, negatively impacting individuals through higher emotional exhaustion, greater turnover intent, lower satisfaction, a lack of support, and reduced promotion. Moreover, workplace gender discrimination practices affect women's skill development; their career progression is often linked to their skill development, and promoting their work advancement requires greater company efforts [9,54], aside from their professional, psychological, and social lives [55]. Ideologies, value systems, cultural norms, beliefs, statuses, and gender roles influence women's skill development and career-

advancement initiatives [56,57]. However, studies have revealed that a significant number of issues facing women's career progression and retention, such as a fear of heights, work–life balance, and exposure to harmful substances on construction sites, can be mitigated through the adoption of technology in the industry [58].

The South African construction industry has a macho culture, which can make it difficult to attract women and for them to be accepted. The absence of substantial gender diversity in the industry has birthed a hostile working environment, as seen in the sexual harassment and poor image of the industry [49,59]. Women in the South African construction industry face discrimination in hiring, promotion, and pay [60,61], and the patriarchal culture has contributed to these challenges [62]. Diversity in South Africa is complex and often associated with conflicts and distrust that make it difficult to manage [63]. Apartheid and the resulting skill shortage have affected people from designated groups [64], promoting the adoption of diversity agendas in the workplace. Although there are legislative mandates to promote gender representation at the top levels, management often approaches gender equity as a compliance issue [65], and women continue to be underrepresented in management positions in the corporate sector [66,67].

Women in leadership positions and those in technical roles will likely experience sexual harassment behaviours such as sexist jokes, inappropriate behaviour, and persistent, unwanted attempts to initiate intimate relationships [68]. However, sexual harassment cases are often difficult to win, and victims are usually intimidated [62,69]. The 'glass ceiling' challenges experienced by women when trying to grow within their sectors are also growing [70]. Throughout most workplaces for ethnic minorities and women, there are institutional and psychological practices that limit their advancement and opportunities [71]. One of the reasons for gender gaps is the public's negative perception of women's presence in engineering and construction education and professions [72]. Determining the pay gap is often complex [61], involving several factors: education, job performance, career history, special skills, role, job stability, wage negotiations, and talent pipelines. Eliminating the pay gap is one of the strategic measures that should be employed to attract and retain female employees in the South African construction industry.

3. Methodology

This study investigates women's critical barriers to entry and retention in construction-related employment in South Africa. These dimensions are crucial in understanding stakeholders' perception of the construction industry. The research began with a systematic review of the existing literature to identify the barriers facing women's entry and retention in construction-related employment in South Africa. This review helped classify barriers from professional conditions and work attributes (BPs), professional perceptions and gender bias (PP), social perception and gender stereotype barriers (SPs), individual confidence/interest/awareness/circumstances-related barriers (IBs), support and empowerment issues (SEs), and educational/academic-related barriers (ABs).

To ensure the robustness of the research findings, a well-defined sampling strategy was employed. The study population comprised construction professionals in the South African construction industry. Using the Yamane formula for sample size calculation and applying a 5% margin of error, the sample size was determined to be 396 respondents. A total of 396 questionnaires were distributed between June and December 2024, of which 109 valid responses were retrieved, yielding a response rate of 27.5%. Though this response rate might seem moderate, it is consistent with past research, indicating that questionnaire-based studies with response rates exceeding 20% are considered satisfactory [73–75]. The responses obtained were deemed sufficient for conducting robust statistical analyses, when compared to other related studies that have used a smaller quantity of data collected from

the research domain [76,77]. In addition, the data collected satisfy the central limit theorem requiring 30 quantitative respondents in order to draw a valid conclusion in a research investigation [78].

The questionnaire was developed based on the insights gained from the literature review. The structured questionnaire consisted of several sections, each focusing on the key dimensions of the aforementioned critical barriers to women's entry and retention in construction-related employment. Respondents were asked to rate various statements related to the barriers using a five-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was distributed through SurveyMonkey and administered to South African construction professionals, encompassing site operatives and site managers.

The reliability test of barriers women face in retention in construction-related employment in South Africa was checked using Cronbach's alpha to pretest the data [79]. The mean of each variable was computed using the Statistical Package of Social Sciences (SPSS version 27). A fuzzy synthetic evaluation (FSE) of the barriers was computed. FSE is a modelling technique from fuzzy set theory for investigating multicriteria decisions and is an artificial intelligence method used for measuring the accuracy of human decisions and is crucial for solving complex problems and vaguely defined fuzzy situations to solve uncertainties and issues of subjectivity [80]. Studies have also indicated that FSE allows for assessing multiple items of criteria in complex entities, converting subjective markers to quantifiable data, and is adaptable in various disciplines [79,81]. In addition, it is useful for prioritising factors in a given group as it ensures a more balanced and realistic ranking, which gives it credence over other methods [82]. FSE is computed based on four steps, namely establishing an FSE index system, estimating the mean score and weighting (W) of items and factors, establishing the membership function (MF), and determining the likelihood index of factors [83].

The evaluation index system for six groups of barriers was defined as U = (u1, u2, u3, u4, u5), representing barriers from professional conditions and work attributes (BPs), professional perceptions and gender bias (PP), social perception and gender stereotype barriers (SPs), individual confidence/interest/awareness/circumstance-related barriers (IBs), support and empowerment issues (SEs), and educational/academic-related barriers (ABs), respectively. The second-level evaluation index within each group of barriers was described as u1 = (u11, u12, . . ., u1n), where n represents the number of items composed of u1. The rating scale for the item evaluation was defined in the order of V = (1, 2, 3, 4, 5), while the second step entails calculating the weighting (W) of items from the mean (μ) and the component factors using Equation (1) and is expressed in the order of the rating scale.

$$W_i = \frac{\mu i}{\sum_{i=1}^{5} \mu_i},\ 0 \leq w_i \leq 1,\ \sum_{i=1}^{5} w_i = 1 \tag{1}$$

The third step entails determining the membership function (MF) of each item of the barrier. The weights assigned by the respondents to each item were used to derive the MF of each item using Equation (2), where MFxm represents the MF of a variable xm; Xbvm (b = 1, 2, . . . 5) represents the percentage of a frequency score the respondents assigned to an item xm; and Xbxm/Vb explains the relation between Xbxm and its alternative associated grade according to the rating scale.

$$MF_{xm} = \frac{K_{1x_m}}{X_1} + \frac{K_{2x_m}}{X_2} + \frac{K_{3x_m}}{X_3} + \frac{K_{4x_m}}{X_4} + \frac{K_{5x_m}}{X_5} \tag{2}$$

The MF of a set (Di) is a multiplication of a fuzzy matrix (Ri) of items and the associated weighting indices. Both Di and Ri can be calculated using Equations (4) and (5).

$$D_i = \begin{bmatrix} MF_{xi1} \\ MF_{xi2} \\ MF_{xi3} \\ \dots \\ MF_{xin} \end{bmatrix} = \begin{bmatrix} K_{1xi1} & K_{2xi1} & \dots & K_{5xi1} \\ K_{1xi2} & K_{2xi2} & \dots & K_{5xi2} \\ K_{1xi3} & K_{2xi3} & \dots & K_{5xi3} \\ \dots & \dots & \dots & \dots \\ K_{1xin} & K_{2xin} & \dots & K_{5xin} \end{bmatrix} \quad (3)$$

$$R_i = W_i \cdot D_i = (w_1, w_2, \dots w_n) \cdot \begin{bmatrix} K_{1xi1} & K_{2xi1} & \dots & K_{5xi1} \\ K_{1xi2} & K_{2xi2} & \dots & K_{5xi2} \\ K_{1xi3} & K_{2xi3} & \dots & K_{5xi3} \\ \dots & \dots & \dots & \dots \\ K_{1xin} & K_{2xin} & \dots & K_{5xin} \end{bmatrix} = (r_{i1}, r_{i2}, \dots r_n) \quad (4)$$

Finally, the FSE methodology involves quantifying the significant index of the group of barriers facing women's entry and retention in construction-related employment in South Africa. The significant index is the product of the grading system (q = 1, 2, 3, 4, 5) and fuzzy evaluation matrix (Ri) given through using Equation (5).

$$SI = \sum_{i=n}^{5} (R_i \times Q_i) = 1 \leq \text{SI} \leq 5 \quad (5)$$

4. Data Analysis and Results

4.1. Background Information of Respondents

The background information of the respondents is shown in Table 1. The respondents include males (56.9%) and females (43.1%), indicating an almost equitable representation of both genders. Most of the respondents were aged 35–44 years, with the following education levels: no formal education (39.4%), apprenticeship (11.0%), vocational qualification (12.8%), diploma (28.4%), master's degree (7.3%), and doctorate degree (0.9%). Altogether, a larger percentage of the respondents have under 15 years of working experience. Detailed background information of the respondents is presented in Table 1.

Table 1. Background information of respondents.

Background Information	Items	Frequency	Percentage
Gender	Male	62	56.9
	Female	47	43.1
Age	25–34 years	14	12.8
	35–44 years	44	40.4
	45–54 years	28	25.7
	55–64 years	17	15.6
	65 years and above	6	5.5
Position	Junior employee	13	11.9
	Senior employee	4	3.7
	Junior management	6	5.5
	Senior management	8	7.3
	Main lead	4	3.7
	Director	39	35.8
	Others	35	32.1

Table 1. *Cont.*

Background Information	Items	Frequency	Percentage
Academic qualification	No formal education	43	39.4
	Apprenticeship	12	11.0
	Vocational qualification	14	12.8
	Diploma	31	28.4
	Master's degree	8	7.3
	PhD	1	0.9
Size of organisation	Micro enterprise (Fewer than 10 employees)	30	27.5
	Small enterprise (10 to 49 employees)	33	30.3
	Medium enterprise (50 to 249 employees)	9	8.3
	Large enterprise (250 and more employees)	14	12.8
	Others	23	21.1
Years of working experience	0–5 years	42	38.5
	6–10 years	25	22.9
	11–15 years	27	24.8
	16–20 years	8	7.3
	More than 20 years	7	6.4

4.2. Cross-Tabulation of Respondents' Background Information

The cross-tabulation of the respondents' background information, including gender and age, gender and position, and gender and academic qualification, is shown in Tables 2, 3, and 4, respectively. It is essential to have an in-depth understanding of both genders in the study. Table 2 shows that the majority of males and females were aged 35–44 years, while an equal number of both genders were aged 65 years and above. As seen in Table 3, more males (27 respondents) occupied director positions compared to 12 female directors. However, an equal number of males and females are in senior management and main lead positions. Interestingly, most females (three respondents), as opposed to one other responder, are senior employees in their organisations. Table 4 reveals that most respondents without formal education are female. The results show that male respondents possess academic qualifications across more categories than females (see Table 4). The cross-tabulation results show that though the female respondents are not as well-read as their male counterparts, this did not hinder their progression in their career and organisation (see Tables 3 and 4), suggesting their resilience against structural barriers. In addition, some females aged 55 and above are still engaged in the construction workforce, which may indicate their commitment to continually contribute to industry advancement, or indicate the experience and expertise they have gathered over the years which is still considered relevant to their organisations.

Table 2. Cross-tabulation of gender and age of respondents.

		Age					Total
		25–34 Years	35–44 Years	45–54 Years	55–64 Years	65 Years and Above	
Gender	Male	6	28	14	11	3	62
	Female	8	16	14	6	3	47
Total		14	44	28	17	6	109

Table 3. Cross-tabulation of gender and position of respondents.

		Position							Total
		Junior Employee	Senior Employee	Junior Management	Senior Management	Main Lead	Director	Others	
Gender	Male	9	1	4	4	2	27	15	62
	Female	4	3	2	4	2	12	20	47
Total		13	4	6	8	4	39	35	109

Table 4. Cross-tabulation of gender and academic qualification of respondents.

		Academic Qualification						Total
		No Formal Qualification	Apprenticeship	Vocational Qualification	Diploma	Master's Degree	PhD	
Gender	Male	17	11	11	17	5	1	62
	Female	26	1	3	14	3	0	47
Total		43	12	14	31	8	1	109

4.3. Opinions of Both Genders on the Barriers Facing Women's Entry and Retention in Construction-Related Employment

The Shapiro–Wilk test value, mean score, standard deviation, Mann–Whitney U test values, and alpha values of the barriers to women's entry and retention in construction-related employment are shown in Table 5. The results of the Shapiro–Wilk test indicate that the normality of the dataset is less than 0.05, implying that the data are not normally distributed, hence the use of a non-parametric test (Mann–Whitney U test). The mean score values of the variables in 'Barriers from professional conditions and work attributes' for males range from 3.226 (BP2) to 3.742 (BP1), while the female rating ranges from 3.298 (BP3) to 3.809 (BP4). Interestingly, there is no significant difference in the opinions of both genders in the nine items that describe the barriers to professional conditions and work attributes.

Table 5. Opinions of respondents on the barriers based on the gender of the respondents.

Barriers	S-W (Sig)	Male		Female		M-W (Sig)	Alpha
		Mean	SD	Mean	SD		
Barriers from Professional Conditions and Work Attributes (BP)							*0.917*
BP1—Highly competitive environment, being unwelcoming and lacking support	0.000 *	3.742	1.241	3.681	1.353	0.924	
BP2—Queen bee syndrome in the workplace: women competing and hindering other women	0.000 *	3.226	1.260	3.638	1.293	0.098	
BP3—Difficulty in finding work-life balance	0.000 *	3.597	1.194	3.298	1.443	0.352	
BP4—Qualification gap between women and men	0.000 *	3.452	1.289	3.809	1.245	0.135	
BP5—Career insecurity (short-term contracts, grant-dependent positions)	0.000 *	3.403	1.311	3.766	1.289	0.115	
BP6—Lack of supportive facilities in the working environment (e.g., creche, single-sex toilets)	0.000 *	3.306	1.262	3.340	1.508	0.752	
BP7—Slow career progression	0.000 *	3.613	1.164	3.489	1.428	0.852	
BP8—Difficulty to return to the construction industry careers after a pause or leave	0.000 *	3.613	1.178	3.787	1.284	0.322	
BP9—Difficulty in securing positions in the same geographical area as their partners or children	0.000 *	3.677	1.170	3.723	1.297	0.687	
Professional Perceptions and Gender Bias (PP)							*0.811*
PP1—Income inequality/gender pay gap	0.000 *	3.387	1.430	3.957	1.215	0.032 *	
PP2—Women being discouraged or dismissed from managerial and leadership positions	0.000 *	3.065	1.401	3.745	1.310	0.010 *	

Table 5. *Cont.*

Barriers	S-W (Sig)	Male		Female		M-W (Sig)	Alpha
		Mean	SD	Mean	SD		
PP3—Bullying or sexual harassment against women	0.000 *	3.177	1.542	3.957	1.429	0.004 *	
Social Perception and Gender Stereotypes Barriers (SP)							*0.912*
SP1—Women are perceived with lower physical and mental abilities	0.000 *	3.274	1.528	3.511	1.487	0.444	
SP2—Women are perceived as less rational and more emotional	0.000 *	3.500	1.534	3.787	1.444	0.294	
SP3—Perception that the construction industry is not appropriate for women	0.000 *	3.226	1.407	3.745	1.539	0.035 *	
SP4—Lack of respect for women in construction industry careers	0.000 *	3.339	1.470	3.809	1.296	0.097	
SP5—Preferential treatment for men	0.000 *	3.419	1.362	3.809	1.377	0.099	
SP6—Perception that women's common role in society is being a primary carer for children or other family members	0.000 *	3.403	1.408	3.936	1.258	0.039 *	
Individual Confidence/Interest/Awareness/Circumstances Related Barriers (IB)							*0.903*
IB1—Lack of self-confidence about own skills and abilities	0.000 *	3.048	1.408	3.809	1.329	0.004 *	
IB2—Self-imposed fear of construction-related activities	0.000 *	3.161	1.439	3.957	1.351	0.001 *	
IB3—Lack of confidence to apply for positions and promotions	0.000 *	3.032	1.414	3.787	1.334	0.005 *	
IB4—Lack of personal interest in construction-related fields	0.000 *	3.113	1.450	3.787	1.334	0.014 *	
IB5—Lack of awareness of educational opportunities in construction fields	0.000 *	3.323	1.469	3.915	1.282	0.030 *	
IB6—Lack of awareness of career opportunities in construction related fields	0.000 *	3.194	1.458	3.979	1.327	0.003 *	
IB7—Girls have less curiosity, desire, appetite and motivation towards information or knowledge about construction	0.000 *	3.290	1.360	3.766	1.339	0.058	
Support and Empowerment Issues (SE)							*0.880*
SE1—Lack of professional mentorship, career counselling and supervision opportunities for females	0.000 *	3.419	1.409	3.979	1.260	0.031 *	
SE2—Lack of encouragement from men	0.000 *	3.516	1.184	3.915	1.195	0.068	
SE3—Lack of encouragement and support from family members and friends/peers	0.000 *	3.274	1.393	3.766	1.306	0.059	
SE4—Lack of access to vocational construction-related training and development opportunities	0.000 *	3.548	1.237	3.979	1.343	0.027 *	
SE5—Ineffective programs to attract women to challenging and competitive jobs and positions	0.000 *	3.645	1.307	3.809	1.439	0.346	
SE6—Lack of strategies and policies for gender balance in construction-related fields	0.000 *	3.629	1.283	3.766	1.355	0.461	
Educational/Academic-related Barriers (AB)							*0.851*
AB1—Educational expenses and costs	0.000 *	3.677	1.252	3.957	1.250	0.177	
AB2—Time required to acquire construction related qualification	0.000 *	3.258	1.305	3.830	1.388	0.017 *	
AB3—Construction industry education directed at boys	0.000 *	3.355	1.344	3.723	1.347	0.126	
AB4—Difficult to balance education and other life commitments	0.000 *	3.371	1.440	3.447	1.442	0.755	

Note: S-W = Shapiro–Wilk test, SD = standard deviation, M-W = Mann–Whitney U test, * = significant at <0.05.

The detailed mean score of both males and females for professional perceptions and gender bias (PP), social perception and gender stereotype barriers (SPs), individual confidence/interest/awareness/circumstance barriers (IBs), support and empowerment issues (SEs), and educational/academic-related barriers (ABs) are over 3.000 on the Likert scale. However, a significant difference in the rating of the respondents is shown in the three variables of Professional Perceptions and Gender Bias (PP), specifically income inequality/gender pay gap (PP1), women being discouraged or dismissed from managerial and leadership positions (PP2), and bullying or sexual harassment against women (PP3), with significant differences of 0.032, 0.010, and 0.004, respectively. The mean score rating of the female respondents is also higher than that of the male respondents for these items.

For 'Social Perception and Gender Stereotypes Barriers (SP)', two items, namely 'perception that the construction industry is not appropriate for women (SP3)', and 'the perception that women's typical role in society is a primary carer for children or other

family members (SP6)', have significant differences of 0.035 and 0.039, with the female respondents having a higher mean rating than the male respondents. Interestingly, all the items describing individual confidence/interest/awareness/circumstance-related barriers (IBs), except 'girls have less curiosity, desire, appetite and motivation towards information or knowledge about construction (IB7)', have significant differences. It is worth noting that the female respondents gave a higher rating in response to (IB7), with a mean score of 3.766 compared to their male counterparts (mean = 3.290).

'Support and Empowerment Issues (SE)' contained two items, i.e., 'lack of professional mentorship, career counselling and supervision opportunities for females' (SE1) and 'lack of access to vocational construction-related training and development opportunities' (SE4), with significant differences of 0.031 and 0.027. Finally, only 'the time required to acquire construction-related qualification (AB2)' shows a significant difference—of 0.017—for 'Educational/Academic-related Barriers (AB)'. Table 5 also shows the alpha (α) value of each group of barriers, as follows: BP: $\alpha = 0.917$, PP: $\alpha = 0.811$, SP: $\alpha = 0.912$, IB: $\alpha = 0.903$, SE: $\alpha = 0.880$, and AB: $\alpha = 0.851$, which are higher than the standard benchmark of 0.6.

Table 6 shows the overall mean value of each barrier to women's retention in construction employment computed using SPSS version 27, and their associated weighting calculated using Equation (1). The mean value of the construct in the barrier, namely barriers from professional conditions and work attributes (M = 3.321 to 3.716), professional perceptions and gender bias (M = 3.358 to 3.633), social perception and gender stereotype barriers (M = 3.376 to 3.633), individual confidence/interest/awareness/circumstance-related barriers (M = 3.358 to 3.578), support and empowerment issues (M = 3.486 to 3.734), and educational/academic-related barriers (M = 3.404 to 3.798) are above 3.00. The weighting of each barrier was computed from the mean of the respondents' ratings. For example, the weighting of SP3 was estimated as follows:

$$W_{SP_3} = \frac{\mu_{SP3}}{\mu_{SP1} + \mu_{SP2} + \mu_{SP3} + \mu_{SP4} + \mu_{SP5} + \mu_{SP6}}$$

$$W_{SP_3} = \frac{3.450}{3.376 + 3.624 + 3.450 + 3.541 + 3.587 + 3.633} = \frac{3.450}{21.211} = 0.163$$

Table 6. Membership function of barriers facing women's entry and retention in construction-related employment in South Africa.

Barriers	Mean	Weighting	MFs (Level 2)					MFs (Level 1)				
Barriers from Professional Conditions and Work Attributes (BPs)	***32.018***							***(0.103,***	***0.097,***	***0.223,***	***0.282,***	***0.294)***
BP1	3.716	0.116	(0.08,	0.09,	0.23,	0.22,	0.38)					
BP2	3.404	0.106	(0.09,	0.15,	0.30,	0.18,	0.28)					
BP3	3.468	0.108	(0.13,	0.09,	0.21,	0.32,	0.25)					
BP4	3.606	0.113	(0.10,	0.07,	0.26,	0.26,	0.31)					
BP5	3.560	0.111	(0.13,	0.06,	0.20,	0.33,	0.28)					
BP6	3.321	0.104	(0.14,	0.15,	0.23,	0.23,	0.26)					
BP7	3.560	0.111	(0.10,	0.11,	0.19,	0.32,	0.28)					
BP8	3.688	0.115	(0.08,	0.09,	0.17,	0.36,	0.29)					
BP9	3.697	0.115	(0.08,	0.07,	0.22,	0.31,	0.31)					
Professional Perceptions and Gender Bias (PP)	*10.505*							***(0.143,***	***0.130,***	***0.153,***	***0.233,***	***0.348)***
PP1	3.633	0.346	(0.10,	0.14,	0.16,	0.24,	0.37)					
PP2	3.358	0.320	(0.14,	0.17,	0.17,	0.25,	0.28)					
PP3	3.514	0.335	(0.19,	0.08,	0.13,	0.21,	0.39)					

Table 6. *Cont.*

Barriers	Mean	Weighting	MFs (Level 2)	MFs (Level 1)
Social Perception and Gender Stereotype Barriers (SPs)	*21.211*			***(0.151, 0.094, 0.187, 0.206, 0.364)***
SP1	3.376	0.159	(0.20, 0.09, 0.15, 0.25, 0.31)	
SP2	3.624	0.171	(0.16, 0.09, 0.16, 0.17, 0.43)	
SP3	3.450	0.163	(0.16, 0.14, 0.17, 0.18, 0.36)	
SP4	3.541	0.167	(0.14, 0.10, 0.19, 0.22, 0.35)	
SP5	3.587	0.169	(0.13, 0.07, 0.24, 0.20, 0.36)	
SP6	3.633	0.171	(0.12, 0.08, 0.21, 0.22, 0.37)	
Individual Confidence/Interest/Awareness/ Circumstance-Related Barriers (IBs)	*24.248*			***(0.149, 0.113, 0.189, 0.222, 0.327)***
IB1	3.376	0.139	(0.17, 0.09, 0.24, 0.21, 0.29)	
IB2	3.505	0.145	(0.15, 0.14, 0.12, 0.26, 0.34)	
IB3	3.358	0.138	(0.17, 0.09, 0.21, 0.25, 0.28)	
IB4	3.404	0.140	(0.17, 0.10, 0.20, 0.23, 0.30)	
IB5	3.578	0.148	(0.13, 0.11, 0.19, 0.19, 0.38)	
IB6	3.532	0.146	(0.15, 0.11, 0.17, 0.20, 0.37)	
IB7	3.495	0.144	(0.11, 0.15, 0.20, 0.22, 0.32)	
Support and Empowerment Issues (SEs)	***21.972***			***(0.104 0.085, 0.207, 0.250, 0.356)***
SE1	3.661	0.167	(0.12, 0.08, 0.19, 0.23, 0.38)	
SE2	3.688	0.168	(0.06, 0.11, 0.26, 0.25, 0.33)	
SE3	3.486	0.159	(0.13, 0.11, 0.22, 0.23, 0.31)	
SE4	3.734	0.170	(0.10, 0.06, 0.20, 0.27, 0.37)	
SE5	3.716	0.169	(0.11, 0.09, 0.17, 0.24, 0.39)	
SE6	3.688	0.168	(0.11, 0.06, 0.20, 0.28, 0.35)	
Educational/Academic-related Barriers (ABs)	***14.221***			***(0.113, 0.109, 0.220, 0.219, 0.341)***
AB1	3.798	0.267	(0.08, 0.06, 0.21, 0.26, 0.39)	
AB2	3.505	0.246	(0.11, 0.14, 0.22, 0.20, 0.33)	
AB3	3.514	0.247	(0.12, 0.11, 0.22, 0.24, 0.31)	
AB4	3.404	0.239	(0.15, 0.13, 0.23, 0.17, 0.33)	

It is expected that the estimation of the weightings of the construct in each group must be equal to or approximately equal to 1.

4.4. Membership Function Calculation for Barriers (Level 2)

The membership functions (MF) in the FSE range from 0 to 1 [83] and the designation from which the MFs are obtained is crucial [79]. The intrinsic terms deployed to evaluate the construct in each barrier use a five-point Likert scale, ranging from 1 (representing 'strongly disagree') to 5 (implying 'strongly agree'). Thus, the MF of a variable was computed using Equation (3) for 'SP' (variable 3). SP_3, based on the ratings of respondents—'strongly disagree = 16%', 'disagree = 14%', 'neutral = 17%', 'agree = 18%', and 'strongly agree = 36%'—is illustrated as

$$MF_{SP_3} = \frac{0.16}{\text{Strongly disagree}} + \frac{0.14}{\text{disagree}} + \frac{0.17}{\text{Neutral}} + \frac{0.18}{\text{agree}} + \frac{0.36}{\text{strongl yagree}} = (0.16, 0.14, 0.17, 0.18, 0.36)$$

In the same vein, the MFs for all the barriers were calculated from the respondents' ratings and presented in Table 6.

4.5. Membership Function Calculation for Barriers (Level 1)

The MFs (Level 1) were computed using Equation (4) by the multiplication of the MFs (Level 2) of constructs for each barrier, with the associated weighting derived from

Equation (1). For example, the 'Social Perception and Gender Stereotypes Barriers' (Level 1) is estimated as follows:

$$R_{SP} = (0.159,\ 0.171,\ 0.163,\ 0.167,\ 0.169,\ 0.171) \times \begin{bmatrix} 0.20 & 0.09 & 0.15 & 0.25 & 0.31 \\ 0.16 & 0.09 & 0.16 & 0.17 & 0.43 \\ 0.16 & 0.14 & 0.17 & 0.18 & 0.36 \\ 0.14 & 0.10 & 0.19 & 0.22 & 0.35 \\ 0.13 & 0.07 & 0.24 & 0.20 & 0.36 \\ 0.12 & 0.08 & 0.21 & 0.22 & 0.37 \end{bmatrix}$$

$$R_{SP} = (0.151, 0.094, 0.187, 0.206, 0.364)$$

By using the same approach, the remaining MFs (Level 1) for the six groups of barriers were calculated and presented in Table 6.

4.6. Significant Index for Critical Barriers Facing Women's Entry and Retention in Construction-Related Employment

The membership function of each category of barrier was used to determine their significant index (S.I.) to determine their level of priority (see Table 7). From the calculation, "Support and Empowerment Issues" has the highest SI of 3.675, followed by "Educational/academic Barriers" with SI of 3.572, and the group of barriers with the smallest score is "Individual Confidence/Interest/Awareness/Circumstances Related Barriers", with an SI of 3.465.

Table 7. Significant index computation of critical barriers.

Factors	MFs (Level 1)	Significant Index Calculation	S.I.	Rank
Barriers from Professional Conditions and Work Attributes (BPs)	(0.103, 0.097, 0.223, 0.282, 0.294)	(0.103 × 1) + (0.097 × 2) + (0.223 × 3) + (0.282 × 4) + (0.294 × 5)	3.564	3
Professional Perceptions and Gender Bias (PP)	(0.143, 0.130, 0.153, 0.233, 0.348)	(0.143 × 1) + (0.130 × 2) + (0.153 × 3) + (0.233 × 4) + (0.348 × 5)	3.534	5
Social Perception and Gender Stereotype Barriers (SPs)	(0.151, 0.094, 0.187, 0.206, 0.364)	(0.151 × 1) + (0.094 × 2) + (0.187 × 3) + (0.206 × 4) + (0.364 × 5)	3.544	4
Individual Confidence/Interest/Awareness/Circumstance-Related Barriers (IBs)	(0.149, 0.113, 0.189, 0.222, 0.327)	(0.149 × 1) + (0.113 × 2) + (0.189 × 3) + (0.222 × 4) + (0.327 × 5)	3.465	6
Support and Empowerment Issues (SEs)	(0.104, 0.085, 0.207, 0.250, 0.356)	(0.104 × 1) + (0.085 × 2) + (0.207 × 3) + (0.250 × 4) + (0.356 × 5)	3.675	1
Educational/Academic-related Barriers (ABs)	(0.113, 0.109, 0.220, 0.219, 0.341)	(0.113 × 1) + (0.109 × 2) + (0.220 × 3) + (0.219 × 4) + (0.341 × 5)	3.572	2

5. Discussion

The analysis results show the S.I. of different constructs of barriers for the entry and retention of women in the construction industry. For the significant index values, seen in Table 7, the ranking of the barriers is as follows: support and empowerment issues (SEs), educational/academic-related barriers (ABs), barriers from professional conditions and work attributes (BPs), social perception and gender stereotype barriers (SPs), professional perceptions and gender bias (PP), and individual confidence/interest/awareness/circumstance-related barriers (IB).

5.1. Support and Empowerment Issues

Of the six clusters of critical barriers to women's entry and retention in construction employment, support and empowerment issues (SEs) ranked highest in this study. The support and empowerment issues consist of a lack of professional mentorship, encouragement from men and family members, a lack of access to construction-related training, and a lack

of strategies for gender balance in the construction industry. In reality, a male-dominated industry may not have much support for women, especially in an environment with much less focus on gender equality. For example, the lack of professional mentorship, counselling, and supervision for females could be a major barrier because mentors may often be of the opposite gender in the construction industry [53]. To avoid other possible barriers for females, such as sexual harassment, it is likely that women may be dissuaded from being mentored. Interestingly, such discouragement that hinders women from receiving mentorship and support where available could be from family members and friends who stress the possible impediments to receiving mentorship from the opposite gender [13]. The patriarchy culture in South Africa could also contribute to low levels of entry and retention of women in a male-dominated industry. A patriarchal culture hinders women from furthering their education in South Africa [84], and a male counterpart with a patriarchal mindset may exhibit some uncomfortable characteristics against women in the industry. In particular, Ngqentsu [62] and Aneke et al. [85] revealed that patriarchal behaviour in South Africa contributes to the challenge faced by women working in the construction industry. Another significant barrier is the lack of access to vocational construction-related training and development opportunities (SE4), which characterise the problem women face in their entry, retention, and career progression journey. Construction-related roles require training, upskilling, and lifelong learning to meet the changing trends in the industry, which can be time-demanding, especially when other domestic responsibilities have taken a toll on women [86]. Therefore, the need to be proactive in policy formulation to encourage female inclusion is essential.

5.2. Educational/Academic-Related Barriers

The variables captured under 'educational-related barriers' include educational expenses (AB1), time required to acquire construction-related qualifications (AB2), construction industry education directed at boys (AB3), and difficulty in balancing education and other life commitments (AB4). In reality, acquiring a university degree in any chosen discipline could cost a fortune depending on the type of institution where the degree is to be acquired (private or public university), the location of the degree, and the income group of one's parents. In past studies, economic and poverty-related issues are often fundamental reasons for women and girls not being able to attend formal education [13], which has informed scholarships for girls [87] and educational policy [88]. Although the time required to acquire construction-related qualifications, such as in architecture, may be more than for the social sciences in some institutions, the extra year(s) may not be sufficient to hinder women's entry and retention in construction-related employment. The extra year(s) required to acquire a construction-related degree allow students to have hands-on experience in the form of students' industrial work experience schemes (SIWESs) in their chosen disciplines, which can be a starting point in their career pursuit. Thus, it is arguable that construction industry education is directed at boys (AB3) because the curriculum aims to form construction professionals without regard to gender. On the other hand, due to the patriarchal South African society, teachers and tutors may (un)consciously focus on male students.

5.3. Barriers from Professional Conditions and Work Attributes

The factors constituting the barriers in professional conditions and work attributes comprise the industry's competitiveness, difficulty in work–life balance, the qualification gap between genders, career insecurity, a lack of supportive facilities on construction sites, and slow career progression. In reality, the construction industry is stressful and has safety-related concerns, as compared to other industries [89]. The short time frame often

given to contractors to deliver projects to clients also necessitates construction workers to work overtime, which may negatively affect work–life balance (BP3). Thus, the industry is male-dominated, possibly because women often have most domestic responsibilities for caring for children and the home [13] and because of the perceived subordinated roles of women in the family [84]. Furthermore, a patriarchal society like South Africa's can exacerbate this condition by giving preference to males, offering smaller wages, and providing limited career advancement for women [61]. The lack of supportive facilities in the working environment may be peculiar to construction sites. However, the need to give privacy to women workers is essential. The difficulty in securing positions in the same geographical area as their partners or children is also a key barrier. For example, most construction workers in the Hong Kong industry are migrant workers whose wives and relatives are in their home country [90]. Problems associated with a difficulty of returning to a construction industry career after a pause or leave (BP8) can be particular to women during pregnancy and for those who have experienced other maternity-related issues.

5.4. Social Perception and Gender Stereotype Barriers

The social perception and gender stereotype barriers depicted in this study clearly show opinions on women's physical capability, emotional status, and maternal status. Interestingly, the female respondents gave higher ratings to the constructs than the male respondents (see Table 5). Although the societally perceived role of care for the family is attributed to women, some females are still fostering and making significant advancements in the construction industry, possibly explaining the considerable difference of 0.039 obtained in this study. The social perception of the maternal care role of women is not peculiar to the construction industry and South Africa [84,91]. However, some developed nations employ domestic helpers, allowing women time to pursue their careers [92]. The findings on preferential treatment for men align with findings in other developed nations such as Pakistan [15] and Jordan [14], and with past studies in South Africa [61,93]. However, preferential treatment for men may be a reality of the stressful nature of the industry which men can manage, which is also indicated in the rating for SP1 (women are perceived as having lesser physical and mental abilities). According to Gipson et al. [94], women are less rational and more emotional (SP2) because females who occupy top management positions also record outstanding performance. It is interesting to find a significant difference of 0.035 in the perception that the construction industry is not appropriate for women (SPS), which implies that each gender has roles that can fit into their capabilities, contributing to overall project outcomes. In addition, a limited number of women may also possess physical strength comparable to that of men to work.

5.5. Professional Perceptions and Gender Bias

The barriers in this construct consist of inequality in wages (PP1), discouragement of women from managerial and leadership positions (PP2), and bullying or sexual harassment against women (PP3). The findings on the inequality in wage payment in this study align with the study of Kabeer et al. [95], which found that in Bangladesh, women are often less paid than men for the same job position and job description. The finding on discouraging women from managerial and leadership positions confirm a similar position for other developing nations. Although the findings in most studies on the non-involvement of women in leadership positions could be linked to the patriarchal culture or religious views [13,15], the situation in South Africa could distinctively stem from the patriarchal nature of the society, forming the bedrock for entrenched ideology supporting structural hinderance to career progression, systemic capitalist exploitation, and which relegating women's involvement in the industry [62]. The construct of bullying and sexual harassment

against women (PP3) has the same mean value of 3.957 as the inequality in wages construct for the women respondents. Unfortunately, South Africa is designated as one of the most dangerous countries, with a high crime rate in urban areas, which can be dangerous for women. A similar pattern in Brazil can be attributed to the history of slave-owing [96]. It is worth noting the significant differences in the opinions of the male and female respondents on the constructs of professional perception and gender bias (PP) in this study. Perhaps women engaged in large, multi-national organisations may not experience wage and salary discrepancies. This implies that an organisation's international exposure may warrant engaging women expatriates from nations where gender equality is embraced.

5.6. Individual Confidence/Interest/Awareness/Circumstance-Related Barriers

It is interesting that individual-related barriers are the smallest drawback women face for entry and retention in the construction industry. The analysis implies that individual barriers to women fulfilling their potential in a career in the construction sector may be infinitesimal compared to social and cultural barriers. On the other hand, the individual perception of barriers may be primarily based on the self-imposed fear of construction-related activities (IB2) and real-time cases of seeing the strenuous activities undertaken by construction workers and professionals. However, some women have made significant impacts in the construction industry, which can strongly motivate other females to pursue careers in the sector [13]. Thus, disseminating platforms and courses for women to thrive in the industry can motivate female students to pursue their careers in the construction industry.

6. Recommendations and Practical Implementations

6.1. Recommendations

FSE was used to show the critical order of the barriers. Based on the findings, some practical recommendations were deemed necessary to mitigate the barriers facing women's entry and retention in construction-related employment. The most critical of the barriers are support and empowerment issues (SEs), which reflect the lack of mentorship, training, and support for women in this male-dominated sector. Therefore, higher education institutions should offer construction-related courses that educate, mentor, and train women, with a special focus on an inclusive environment, and promoting female academics, researchers, and business leaders as the key role models for young students and professionals. In addition, on-the-job tutoring and training are essential for women to further their expertise in assigned tasks. Proactive government-funded mentoring programmes can be organise to pair female construction workers with industry leaders for tutelage in career progression. It is also important to enforce gender equality policy in South Africa to encourage women's participation in industries of their choice without fear or prejudice. Furthermore, flexible work arrangement can be formulated for women to allow them to better accommodate other family-related tasks when necessary.

This study reveals that educational/academic-related barriers (ABs) are the second most critical barrier facing women's retention in construction-related employment in South Africa. Of the four items describing the academic-related barriers (ABs), a significant difference is noticed in the time required to acquire construction-related qualifications. Although the time is justifiable, there may be a need to re-iterate the need for additional year(s) necessary to acquire construction-related degrees for students, parents, and guardians. In addition, the advantages and importance of work experience schemes that possibly add to the years required to acquire construction-related skills should also be emphasised.

Although the barriers from professional conditions and work attributes (BPs) characterise the real situation in the industry, it could still be an attractive industry for females to pursue their careers in. For example, the problem associated with work–life balance in the

construction industry may not be peculiar to women in the sector. Therefore, the industry should educate women on strategies for balancing work and family-related activities. Onsite childcare facilities through public–private partnerships can be formulated to encourage women's involvement in the industry. In addition, innovative methodologies and techniques can enhance the delivery of professional services in construction organisations. This implies that the educational sector also needs to continually include the teaching of such innovative and digital technologies in their curriculum for women to learn in their academic pursuits.

The barriers related to social perception, gender stereotypes (SPs), professional perceptions, and gender bias (PP) require urgent action from various stakeholders. First, the government and professional bodies should address the inequality in wages by formulating and enforcing policies condemn such 'differentialism' in wages. Regular salary audits should be carried out to ensure that construction organisations comply with the policy formulated. Second, recruitment organisations and construction organisation owners should also be encouraged to be fair in the salaries advertised in job descriptions and in roles paid to workers regardless of gender. Moreover, the need for a public information campaign is also deemed essential to address any gender bias related to the construction sector. The government also need to mandate gender quotas in construction tenders to encourage active female participation in the industry. Finally, appropriate sanctions and punishment should be given to construction organisations, recruiters, and supervisors who partake in any disparity in the industry.

The results of the analysis revealed that individual confidence/interest/awareness/circumstance-related barriers (IBs) are the least common barriers facing women entering and progressing in the construction industry in South Africa. Therefore, it is important to publicise and increase awareness of the possibility of women thriving in the construction industry via social media and other platforms. This would help to create a mind-shift that could reduce self-imposed or family- and friend-induced barriers that could deter women from pursuing careers in the construction industry.

6.2. Theoretical Contribution

This study contributes theoretically to the literature on female work-related barriers, especially in the construction sector, which is male-dominated. The barriers facing women in the South African construction industry are obtained through a survey of construction professionals. The findings enrich the theoretical framework of female education in the construction sector and highlight the impending barriers to entry and retention in an industry and sector characterised by limited female women participation. The findings of this study can be useful for various stakeholders—namely professional construction organisations, academic institutions, government organisations, policy makers, non-government organisations, parents and guardians, and students in higher learning—to mitigate professional, societal, industry-related, and individual-related barriers in the South African construction industry.

6.3. Managerial Implications

The distinctive characteristics of women can enable them to bring about solutions that contribute to sustainability and address the skilled labour shortage in the construction sector. This study provides both professional bodies and education stakeholders with an understanding of barriers that can hinder the social sustainability of the construction industry in the country. Therefore, management officers in educational institutions should organise forums for female students to be educated on opportunities to thrive in the industry. Respected and influential women in the industry could also mentor younger ones

navigating their way to the top in the male-dominated sector. Higher institutions could also increase their quota for female students' admission in construction-related courses and could provide female students with very good performance in their chosen careers with rewards. In addition, professional bodies in the construction industry should organise seminars, conferences, and symposiums for secondary school students to motivate females to pursue careers in the construction industry. Finally, policymakers in governmental and non-governmental organisations should be proactive in policy formulation and enforcement to address the barriers facing women's entry and retention in the construction industry in South Africa.

7. Conclusions

Gender equality has been a priority in developed nations, culminating in Sustainable Development Goal 5, which many institutions are working towards achieving. However, some developing nations are lagging because of sociocultural and patriarchal barriers. The situation of gender disparity in the construction industry appears to be significant because of the strenuous and complex nature of the sector, which scares women away from pursuing their careers in the industry. This study used surveys to investigate the critical barriers facing women's entry and retention in the South African construction sector. The results of the analysis conducted using FSE revealed the order in which the critical barriers were ranked, given as follows: support and empowerment issues (SEs), educational/academic-related barriers (ABs), barriers from professional conditions and work attributes (BPs), social perception and gender stereotype barriers (SPs), professional perceptions and gender bias (PP), and individual/awareness/circumstance-related barriers (IBs), with significant indexes of 3.675, 3.572, 3.564, 3.544, 3.534, and 3.465, respectively.

Based on the findings of the study, several recommendations and practical implications have been provided to various construction stakeholders. Universities offering construction-related courses are recommended to continually liaise with construction-related organisations to educate and train women studying construction-related courses. In other words, women should be given equal opportunities to learn and acquire skills at various levels in the industry. The need to further stress the importance of additional year(s) used in higher education to acquire construction-related degrees is also deemed important. Other suggestions for mitigating the barriers facing women's entry and retention in the construction industry are highlighted in the recommendation section of this article. Although the study achieved the intended objectives with a moderate sample size, which is adequately justified, there may be a need to obtain more data in future studies to determine any possible differences. A comparison of the findings in this study with findings for other developing nations with similar construction characteristics could also be investigated.

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