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Factors Impacting Women Gaining Leadership Roles in the Jordanian Construction Sector: Architects and Civil Engineers

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Abstract: The persistent underrepresentation of women in leadership positions within the construction industry remains a global concern. In Jordan, despite comprising 60.45% and 22.4% of the total workforce of architects and civil engineers, respectively, women's contribution to management roles is significantly low. Therefore, there is an urgent necessity to examine the factors hindering women's advancement in the construction sector and their ability to attain leadership positions. This research aims to provide an overview of the current situation in Jordan, focusing specifically on the architectural and civil engineering professions. It presents findings from a desktop study, a survey questionnaire, and focus groups. The Severity Index (SI) formula is utilised to identify critical barriers in the Jordanian context, derived from both the literature review and questionnaire responses. Additionally, the Interpretive Structural Modelling (ISM) technique is employed to establish a hierarchy of critical barriers and analyse their interrelationships. The study reveals that the obstacles impeding women from assuming leadership roles in the Jordanian construction sector primarily stem from 20 critical barriers categorised across 11 levels in ISM. Notably, the lack of childcare programmes is identified as a fundamental barrier at the lower level, while informal networks formed by men emerge as the highest-rated barrier at level 11. Addressing and mitigating these challenges is crucial to facilitating women's progression into leadership positions within the sector and is anticipated to contribute significantly to addressing the growing complexity of modern construction projects.

Keywords: construction; women; leadership; Jordan; barriers

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1. Introduction

Globally, the construction sector is projected to expand by approximately $10 trillion by the year 2030 [1]. Consequently, increasing the participation of qualified women in the construction industry is crucial to addressing the significant shortage of skilled personnel, thus enhancing productivity and efficiency [2,3]. Despite the enactment of gender-based employment regulations in many countries, women encounter substantial challenges in environments characterised by masculinity, such as the construction sector [2–6]. In Australia, for instance, women comprise only 12% of the workforce [7], while in the United States, although there has been a notable increase in women employed in the construction industry by approximately 81.3% between 1985 and 2007, they still represent only around 14% of professional and managerial positions [8], primarily occupying junior and support roles [9]. Similarly, in the United Kingdom, while the number of women pursuing academic degrees in construction-related fields is gradually rising [10–12], this has yet to translate

into a significant increase in the proportion of women in managerial and professional roles, where they currently constitute 13.8% [13,14].

In industries where men dominate, women frequently face both horizontal and vertical gender-based obstacles. Horizontal challenges arise when one gender holds more sway, leading to issues such as limited access to support or inadequate representation in the workplace. Vertical challenges emerge from the unequal distribution of men and women within the hierarchy, with one gender being more prevalent in entry and mid-level positions, while only a minority advance to decision-making roles [15]. In recent years, Jordan has seen notable advancements, with job opportunities emerging for highly skilled women in this regard. However, a discernible gap persists between women's performance in their careers and their participation in decision-making processes [16]. Despite ongoing efforts, the representation of women in leadership positions remains strikingly low. In Jordan, women hold less than 5% of board positions, with approximately 78% of construction companies lacking female representation on their boards. In private shareholding companies, women occupy only 9.1% of senior management roles, with a mere 2.6% of these companies having a woman as chairperson. These statistics place Jordan among the lowest globally, even when compared to other Middle Eastern countries with similar cultural and economic contexts [17]. Prevailing societal values, customs, norms, and cultural beliefs often perpetuate stereotypical roles for women, confining them to domestic duties. Gender norms and patriarchal dominance, reinforced by social and religious norms, further entrench traditional gender roles, resulting in a disproportionate representation of men in leadership positions and the marginalisation of women [18]. This disparity contradicts the findings of numerous studies emphasising the importance of women's participation, particularly in leadership roles, for the sustainability of the construction sector. Thus, this study aims to identify the critical barriers hindering women's access to leadership positions in Jordan, focusing on qualified women with degrees in architecture and civil engineering related to construction. It is anticipated that the research findings will significantly contribute to enhancing sustainability in the construction sector.

2. Gender Dimension of the Jordanian Construction Sector

The construction sector in Jordan makes a significant contribution to its Gross Domestic Product (GDP) and employment, with projections suggesting that the Jordanian GDP could increase by $12 billion solely from construction alone, representing approximately 10 percent of the GDP per capita [19]. According to data from the Jordanian Department of Statistics (DOS), GDP from construction surged from 183 million Jordanian dinars (JD) in the first quarter of 2023 to 226 million JD in the second quarter of the same year, marking a substantial 23.5% increase [20]. In terms of employment, the Jordanian construction sector stands as one of the largest employers in the economy [21], ranking as the sixth largest employer during the period between 2015 and 2018 [22].

The inclusion of women, however, remains a critical ongoing concern for the Jordanian construction sector. Achieving gender parity in any industry has the potential to enhance innovation and decision-making capabilities while expanding the available talent pool [23]. However, discussing progress in the construction sector would be incomplete without meaningful and effective integration of women's contributions into its development processes [24]. The socio-economic benefits associated with women's engagement in green construction are widely recognised, including family, environmental, and green energy market-related advantages [25]. In Jordan, despite the increasing number of women obtaining degrees in architecture and civil engineering, they continue to be significantly underrepresented in leadership roles. While the proportion of female architects exceeds that of males at 60.45%, only a select few manage to achieve prominence in the profession [26]. Similarly, women represent 22.4% in the field of civil engineering [26], yet there are notably fewer women in this profession compared to men, with many unfortunately leaving the field to pursue other careers [27]. This trend is attributed to implicit bias, gendered tasking, and societal expectations that create challenges for women to succeed in

this field [28]. Therefore, it is crucial to identify and address barriers hindering women's career development to ensure the sustainability of the construction sector.

3. Factors Influencing Women's Leadership Positions in Construction Projects

There exists a wealth of literature exploring the challenges faced by women in the workplace, particularly regarding their entry into the construction sector and the potential barriers to career progression [15,29,30]. Many studies highlight that the obstacles encountered by women when entering and remaining in the sector are equally significant as their journey towards leadership roles. A thorough examination of the literature reveals that the negative perception of the construction sector as male-dominated stands out as one of the most substantial barriers [16,31]. It is emphasised that this negative perception is perpetuated by a general lack of awareness and limited understanding of the potential career pathways within the construction industry for prospective entrants [31]. Furthermore, despite growing awareness among construction-related professionals, including students and graduates [29], the status of construction as a profession is often viewed unfavourably compared to other career options [31]. Consequently, the construction sector continues to grapple with a negative public image [32]. Alongside this negative image, a prevailing macho culture characterised by conflict, friction, and crisis often permeates relationships within the construction sector [33]. Moreover, the working environment is noted to be highly competitive, prone to conflict, and plagued by instances of discrimination against women [34,35]. Within these male-dominated professions, stereotypes persist regarding the nature of work and the profession [36], with women frequently experiencing a lack of organisational support and instances of sexual harassment across all levels [37]. As a result, women who choose to pursue careers in these professions often feel compelled to adopt "male-oriented values" to navigate their existence within such environments [38].

Barriers hindering women's advancement in the construction sector exist across various levels, ranging from training opportunities to securing strategic positions. Beyond these obstacles, several factors shape their trajectory even before entering the sector. Construction roles are often perceived as male-dominated, primarily due to the physical strength typically associated with the job. Conversely, positions related to childcare are predominantly linked to women, reflecting societal norms regarding nurturing qualities such as love, compassion, and empathy, traditionally regarded as innate to women [39–41]. The caring aspect of femininity is typically not evident in construction sites, which are commonly viewed as rugged and unclean environments deemed unsuitable for women and their feminine traits [42]. The predominance of men in the construction industry can be attributed to the physical demands of the job, challenging work conditions, adverse weather elements, high levels of pressure, limited communication skills among certain workers [43,44], and the prevalence of peer pressure and intense competition [45].

Achieving a work–life balance poses a significant challenge for women in the construction industry. Many women find it difficult to juggle their professional responsibilities with family obligations, leading to negative impacts on both personal and work relationships [46]. The inherent conflict between work and family commitments often makes it nearly impossible for women with career aspirations to effectively manage both aspects simultaneously [47]. Women employed in architecture and civil engineering often contend with long working hours, limiting their ability to fulfil domestic duties and participate in extracurricular activities [48]. Moreover, women encounter invisible barriers throughout their careers, resulting in fewer professional opportunities compared to men [15].

According to a study conducted by the World Bank in 2018, "social norms" and the absence of accessible and affordable childcare services may serve as factors limiting women's opportunities in the workforce. The study also suggests that a significant constraint on female employment is the preferences of men regarding what constitutes suitable work for women, with 70% of respondents expressing disapproval towards women returning home after 5:00 pm [49]. Scholars concur with social cognitive theorists, asserting that societal norms have a considerable influence on women's career development [50]. Additionally,

depending on cultural perspectives, women may be devalued based on their gender [8]. Women often find themselves positioned at the lower end of the labour market, with limited job options, minimal authority in their roles, and lower wages compared to men [17]. In terms of leadership roles within the construction sector, societal expectations steer women away from such positions from a young age, as they are not typically encouraged to develop leadership skills early on [51]. Girls often lack access to education and training that fosters leadership abilities, which impacts their confidence and readiness for leadership roles [52]. Furthermore, women in the construction industry frequently receive insufficient career guidance and have limited educational opportunities as they progress in their careers [45].

The conventional traits typically associated with leadership have historically been linked with masculine qualities, perpetuating the stereotype of the "thinking leader" as synonymous with a man [53]. Nevertheless, previous studies examining women in leadership roles have demonstrated that their presence within organisations has a positive impact on overall performance [54,55]. Women contribute unique value through their leadership, often exhibiting qualities such as honesty, intelligence, and creativity, fostering open communication that enhances employee engagement [56]. Stereotypes and societal norms regarding traditional leadership attributes can significantly influence women's career prospects, leading them to doubt their suitability for positions of authority [57]. This can exacerbate feelings of impostor syndrome, a phenomenon wherein individuals feel undeserving of their accomplishments despite having achieved them legitimately [58]. Research indicates that impostor syndrome can detrimentally affect both personal and professional aspects of individuals' lives, contributing to feelings of anxiety, depression, and reduced motivation, ultimately impacting their work performance negatively [59].

The limited representation of women in male-dominated industries poses challenges for their advancement into higher-level positions [60]. The working environment within the construction sector is predominantly tailored to suit male employees. In terms of health and safety, the often unclean conditions of construction sites can leave women feeling uncomfortable and concerned for their well-being [61]. Additionally, the industry is commonly perceived as hazardous due to its poor safety record, inadequate availability of properly fitting personal protective equipment (PPE), and exposure to substances that may pose reproductive health risks, all of which act as deterrents for women seeking leadership roles within the construction field [32]. The unconventional practices prevalent in construction, coupled with site security measures, contribute to a sense of uncertainty among women [8,60]. Consequently, women employed in architecture and civil engineering roles are more likely to occupy technical specialist positions rather than leadership roles [62].

Women who manage to attain higher positions often do so under challenging circumstances, especially when organisations are not operating optimally [14]. This scenario erects barriers for women, exposing them to heightened scrutiny and pressure, along with negative perceptions regarding their capabilities [63]. They often receive minimal recognition on project sites [3], lack acknowledgment and encouragement from supervisors, are assigned repetitive minor tasks, and are undervalued and unfairly evaluated in comparison to their male counterparts [64]. The metaphorical "glass ceiling" is frequently employed to underscore the limited representation of women in senior positions [65,66], against which women have tirelessly strived to break through biases and discriminatory practices in the workplace [32]. These barriers often originate from recruitment processes that adhere to androcentric norms [15], male-centric training programmes [52], and the absence of incentive programmes specifically designed to support women's career progression [3,14].

A thematic analysis approach [67,68] of the related literature is summarised in Table 1, and thus presents a potential list of factors that are believed to be obstructing women from gaining leadership roles in the construction sector. The barriers identified were summarised and condensed and grouped together with those (variables) that had similar meanings using the affinity diagram technique [69]. In total, 36 variables (barriers) were identified.

Table 1. Barriers obstructing women from gaining leadership roles in the construction sector identified in the literature.

Code	Barriers	Supporting Contributions
B1	The poor negative image of the construction sector	[16,32]
B2	Lack of knowledge of career opportunities	[31,32]
B3	Lack of female role models	[13]
B4	Male-dominated culture	[33–35]
B5	The construction sector is very conflictive	[33,36]
B6	Construction jobs are very competitive	[34–36,45]
B7	Lack of organisational support	[37]
B8	Sexual harassment	[37]
B9	Women have to adopt male attitudes to be accepted in the construction sector	[38]
B10	Hostile work environment, site conditions, physical strength	[38,42,44]
B11	Difficult to combine work and family life	[46,47]
B12	The construction sector does not have flexible work hours	[15,48]
B13	Women face invisible barriers in their career development	[15]
B14	Women taking a break in their career	[15]
B15	Unavailability of childcare programs	[15]
B16	Societal roles and cultural beliefs	[8,50]
B17	Payment discrimination	[17]
B18	Negative perceptions about women's capabilities	[51,52,63]
B19	Male-oriented training programs	[52]
B20	Stereotypes	[53]
B21	Lack of recognition of women's contributions	[57]
B22	Imposter syndrome	[58,59]
B23	Health concerns due to materials hazardous to reproduction	[8,60,61,70]
B24	Lack of availability of personal protective equipment (PPE) in appropriate sizes	[32,61]
B25	Lack of appropriate sanitary facilities at construction sites	[61,70]
B26	Constructions are stressful and demanding	[33,36,45,63]
B27	Constantly asked to perform simple tasks	[64]
B28	Lack of encouragement from supervisors	[3,64]
B29	Lack of female interactions	[4]
B30	Women have greater difficulty controlling subordinates than men	[12,34,61]
B31	Constructions involve harsh working conditions and long working hours	[44,71]
B32	Lack of proper recruitment practices	[35]
B33	Personal female attributes	[8,39–41,56]
B34	Absence of women's incentive programs	[3,14]
B35	Incentive discrimination	[3,14]
B36	Informal networks formed by men	[4]

4. Research Method

In an attempt to evaluate the barriers (variables) that Jordanian women architects and civil engineers face during their entry and advancement in the construction sector, a mixed-method approach using both qualitative and quantitative techniques was adopted.

Initially, a systematic literature search was conducted, followed by a questionnaire survey, and finally, the Interpretive Structural Modelling (ISM) technique was utilised to assess the impact specifically for Jordan. Utilising a mixed-method approach is powerful way to gain insight, make inferences, and draw reliable and valid conclusions.

Systematic literature searches coupled with thematic analysis are well-established techniques that are suitable for analysing large amounts of information over long periods of time [72]. They follow a procedure for collating and categorising publications, providing straightforwardness and reproducibility to the research and literature review results [73]. Published articles from leading databases (Scopus, ISI, Google Scholar) were reviewed using keyword search terms for "women", "barriers", "career development", "stereotypes", "gender", "construction sector/industry", "leadership", "top/senior management", "architects", and "civil engineers". A total of 132 papers were downloaded from online journal outlets and libraries. Of these 132 papers, only 83 were considered sufficient for this study's literature review following manual review. Upon reviewing these publications, 36 barriers were identified and used to formulate the base of the survey questionnaire that was distributed across the Jordanian construction industry to ascertain applicability.

A survey research approach was employed to gather opinions from respondents regarding the critical barriers hindering women from attaining leadership roles in the Jordanian construction sector [74]. The questionnaire consisted of two sections. The first section comprised seven questions aimed at gathering background information (profile) of the respondent, while the second section focused on assessing the relevance of 36 identified barriers in the Jordanian context that impede women from reaching leadership positions in the construction sector. A Likert scale, ranging from 0 (Not found) to 5 (Strongly agree), was utilised to gauge opinions and behavioural variables. The questionnaire was prepared in both English and Arabic for clarity and comprehensibility. It underwent an initial pilot phase, where five expert academic colleagues (three females and two males) in Jordan provided feedback on question complexity, ambiguity, and terminology concerns. All recommendations from the pilot phase were incorporated into the final questionnaire. The survey was distributed online using a web link and disseminated to engineers working across the Jordanian construction sector from July 2023 to November 2023 via emails, WhatsApp messages, and follow-up mobile calls to encourage participation. Following the guidelines for sample size referenced in [75], 384 participants were required to ensure a representative sample for population sizes between 100,000 and 1,000,000, with a 5% margin of error. According to the database of the Jordanian Engineering Association, there were approximately 181,575 registered engineers [26]. Therefore, the questionnaire was sent to 600 engineers employed in the Ministry of Public Works and Housing, as well as site or design engineers (civil, architectural, electrical, and mechanical), contractors, and clients of construction projects. Each respondent was encouraged to forward the survey to their colleagues for completion. After four months of data collection, a total of 419 usable responses were received. Subsequently, the collected data were analysed using SPSS software 26.0, and the reliability of the questionnaire was assessed using Cronbach's alpha test. The calculated Cronbach's alpha for the barriers section was 0.955, indicating high reliability and validity of the collected data for drawing meaningful conclusions [76].

The Severity Index (SI) formula was used to ascertain the severity of a situation or condition based on the responses of the survey questionnaire. SI is commonly used to analyse issues related to social studies, management, construction, and is an ideal formula to rank and define critical barriers, which in turn can be used to drive action plans to improve career progression for females in the construction sector [76]. The Severity Index (SI) formula used was as follows:

$$\text{Severity Index } (SI) = \left(\sum_{i=0}^{5} Wi \times fi \right) \times \frac{100\%}{N}$$

$$Wi = i/N$$

where *SI* = Severity Index—this is computed as a summation of the importance rating; *i* = the rating from 0 to 5; *Wi* = the weight of each rating; *fi* = the frequency of responses for a particular rating point; *N* = the total number of respondents rating a particular factor in the survey.

Following the initial data collection and analysis, the Interpretive Structural Modelling (ISM) method was employed as a second phase to further explore the critical barriers preventing women from attaining leadership positions in Jordan and elucidate the relationships between these barriers. ISM is a methodology utilised to illustrate hierarchical relationships among various factors. Numerous researchers have employed ISM to identify critical barriers impacting sustainability, logistics, and construction endeavours [76–78]. Accordingly, eight experts (comprising four women and four men) from the Jordanian construction sector were selected to participate in a focus group based on their extensive knowledge and expertise, all of whom accepted the invitation. The focus group session was conducted online via the Zoom application. Participants were tasked with constructing an ISM model based on the findings derived from the Severity Index (SI) tests. It was collectively decided to exclude barriers with an SI value of less than 60%, deeming them as weaker barriers. Consequently, 20 barriers were selected for inclusion in the construction of the ISM model. Further elaboration on the ISM approach is provided in the results section.

5. Results

A total of 419 engineers participated in the survey (see Table 2). The majority of respondents were female, comprising 59.4% of the total, while male respondents accounted for 40.6%. However, it is crucial to emphasise the importance of obtaining insights from male respondents in this study, as their perspectives on the barriers are equally valuable. Excluding males from engagement could limit the effectiveness of any actions aimed at improving gender equality. Notably, the minimum educational attainment among participants was a Bachelor of Science (BSc) degree, with a significant portion of female respondents holding a BSc (39.4%), Master's (17.2%), or PhD (2.9%). Among male respondents, the distribution of educational levels was as follows: BSc (32%), Master's (8.6%), and PhD (0.0%). These results underscore the necessity of possessing at least a bachelor's degree in the Jordanian construction sector or a related field, such as architecture or civil engineering, to practise in the profession. Moreover, higher educational qualifications may offer individuals greater opportunities for advancement and attaining higher positions within the construction sector.

Table 2 indicates that approximately equal proportions of architects (53.5%) and civil engineers (46.5%) responded to the survey. Additionally, around one-third of participants reported having 11–15 years of experience in the sector, with only 9.5% having over 20 years of experience. Furthermore, 38.2% of participants were employed in engineering organisations, while 40.8% worked in contractor companies. This distribution suggests that the workload and representation between engineering organisations and contractor companies in the Jordanian construction sector are relatively balanced, providing reliable insights into sector dynamics. Additionally, it is worth noting that the majority of participants (67.1%) had not yet attained a leadership position, compared to only 3.8% who reported having over 10 years of leadership experience.

Each participant was requested to indicate their level of agreement with the 36 identified barriers identified through an in-depth literature review using the Likert scale. The Severity Index (SI) formula was employed to analyse the responses and determine the severity of each situation or condition based on the participants' feedback. The SI for each barrier was computed and subsequently ranked in terms of severity. Table 3 illustrates the SI for the 36 barriers, with separate calculations for female and male respondents to highlight any discrepancies. The findings reveal that the most significant barrier overall is the unavailability of childcare programmes (B15), with an SI of 76.5. This barrier was strongly emphasised by female respondents as the primary critical obstacle, whereas male respondents ranked it as the 12th critical barrier. Notably, men in Jordan tend to believe

that existing childcare facilities in Jordanian cities are adequate, negating the necessity for on-site facilities at workplaces. Conversely, female respondents expressed greater consensus on the significance of barriers, such as the absence of flexible work hours (B12) in the construction sector and the interruption of careers for women (B14), which underscores the common work–family challenges faced by professional women. In contrast, males view societal roles and cultural beliefs (B16) as the primary barrier hindering women from attaining leadership positions. However, despite being ranked 7th overall, this barrier was rated 18th by female respondents.

Table 2. Number and percentage of the profile of survey questionnaire respondents.

Participants' Background	Number and Percent Responses by Gender		Total Number and Percent
	Female	Male	
Overall	249 (59.4%)	170 (40.6%)	419 (100%)
Sector			
Government	88 (21.0%)	0 (0.0%)	88 (21.0%)
Engineering (Designer, Consultant)	124 (29.6%)	36 (8.6%)	160 (38.2%)
Contractor	37 (8.8%)	134 (32.0%)	171 (40.8%)
Education			
Bsc	165 (39.4%)	134 (32.0%)	299 (71.4%)
Master	72 (17.2%)	36 (8.6%)	108 (25.8%)
PhD	12 (2.9%)	0 (0.0%)	12 (2.9%)
Work (engineering)			
Civil	95 (22.7%)	100 (23.9%)	195 (46.5%)
Architecture	154 (36.8%)	70 (16.7%)	224 (53.5%)
Currently in leadership position			
Yes	61 (14.6%)	77 (18.4%)	138 (32.9%)
No	188 (44.9%)	93 (22.2)	281 (67.1%)
Experience in construction sector			
0–5 years	42 (10.0%)	51 (12.2%)	93 (22.2%)
6–10 years	40 (9.5%)	49 (11.7%)	89 (21.2%)
11–15 years	97 (23.2%)	34 (8.1%)	131 (31.3%)
16–20 years	30 (7.2%)	36 (8.6%)	66 (15.8%)
>20 years	40 (9.5%)	0 (0.0%)	40 (9.5%)
Leadership experience in construction sector			
Not yet been in leadership	188 (44.9%)	93 (22.2%)	281 (67.1%)
0–5 years	23 (5.5%)	36 (8.6%)	59 (14.1%)
6–10 years	30 (7.2%)	33 (7.9%)	66 (15.8%)
11–15 years	8 (1.9%)	0 (0.0%)	8 (1.9%)
16–20 years	0 (0.0%)	0 (0.0%)	0 (0.0%)
>20 years	0 (0.0%)	8 (1.9%)	8 (1.9%)

Table 3. Severity Index (SI) score and rank for each barrier.

		Overall		Female		Male	
Code	**Barriers**	**SI**	**Rank**	**SI**	**Rank**	**SI**	**Rank**
B15	Unavailability of childcare programs	76.5	1	80.7	1	70.2	12
B11	Difficult to combine work and family life	75.5	2	68.7	4	85.5	2
B12	The construction sector does not have flexible work hours	73.5	3	72.3	2	75.3	8
B31	Construction constructions involve harsh working conditions and long working hours	72.4	4	67.3	5	79.8	5
B26	Constructions are stressful and demanding	72.1	5	64.1	9	83.8	3
B14	Women taking a break in their career	71.6	6	70.1	3	73.8	9
B16	Societal roles and cultural beliefs	70.6	7	60.3	18	85.8	1
B32	Lack of proper recruitment practices	68.2	8	60.1	19	80.0	4
B10	Hostile work environment, site conditions, physical strength	66.3	9	64.2	7	69.5	13
B5	The construction sector is very conflictive	65.0	10	60.5	16	71.5	10
B4	Male-dominated culture	63.5	11	60.5	17	68.0	14
B36	Informal networks formed by men	63.4	12	61.7	13	66.0	17
B33	Personal female attributes	62.1	13	66.5	6	55.5	30
B25	Lack of appropriate sanitary facilities at construction sites	62.1	14	61.9	11	62.2	20
B8	Sexual harassment	62.1	15	50.3	30	79.5	6
B30	Women have greater difficulty controlling subordinates than men	62.0	16	58.1	21	67.8	15
B21	Lack of recognition of women's contributions	60.8	17	61.8	12	59.3	25
B28	Lack of encouragement from supervisors	60.8	18	57.3	22	66.0	18
B7	Lack of organisational support	60.5	19	60.9	14	60.0	23
B9	Women have to adopt male attitudes to be accepted in the sector	60.2	20	47.9	32	78.2	7
B18	Negative perceptions about women's capabilities	59.9	21	64.2	8	53.5	33
B24	Lack of availability of personal protective equipment (PPE) in appropriate sizes	59.5	22	59.4	20	59.8	24
B34	Absence of women's incentive programs	59.4	23	62.2	10	55.3	31
B13	Women face invisible barriers in their career development	58.4	24	60.7	15	55.1	32
B23	Health concerns due to materials hazardous to reproduction	58.0	25	51.6	28	67.3	16
B35	Incentive discrimination	57.7	26	54.9	23	61.8	22
B29	Lack of female interactions	57.6	27	53.7	25	63.3	19
B3	Lack of female role models	56.9	28	47.2	33	71.1	11
B17	Payment discrimination	56.1	29	54.9	24	57.8	26
B19	Male-oriented training programs	54.7	30	53.7	26	56.2	28
B27	Constantly asked to perform simple tasks	52.7	31	50.7	29	55.8	29
B6	Construction jobs are very competitive	48.8	32	53.7	27	41.8	35
B1	The poor negative image of the construction sector	48.4	33	42.8	35	56.7	27
B20	Stereotypes	47.9	34	38.2	36	62.0	21
B22	Imposter syndrome	47.7	35	46.7	34	49.3	34
B2	Lack of knowledge of career opportunities	40.4	36	48.8	31	28.0	36

Both male and female respondents agreed on the significance of the challenging barrier of balancing work and family life (B11). In this context, employers often perceive

females as more costly to employ due to higher indirect labour costs stemming from increased absenteeism and turnover related to family commitments, as well as the need for childcare programmes. Conversely, employees believe that women bear a significant share of caregiving and household responsibilities [79], despite the fact that both men and women share a similar desire to start a family and must navigate the demands of both work and family life [3].

On the other hand, the male respondents expressed a higher Severity Index (SI) for barriers such as the lack of proper recruitment practices (B32), the need for women to adopt masculine attitudes to be accepted in the sector (B9), and the highly conflict-ridden nature of the construction sector (B5). The construction industry fosters an excessively masculine culture that is unwelcoming and discriminatory towards women [71]. The macho environment poses a real challenge, evidenced by the prevalence of aggressive language and sexual harassment within the construction sector, with nearly all male respondents ranking this barrier (B8) as the 6th most important. Considering these factors, the stressful and demanding nature of the construction sector (B26) emerges as a particularly concerning barrier, with all respondents ranking it 5th in importance collectively and male respondents confirming its significance by ranking it 3rd.

In broad terms, female respondents exhibited a heightened awareness of the intangible barriers to professional advancement (B13). This perception aligns with the existence of a glass ceiling hindering women's career progression [65,66]. Similarly, the negative perceptions regarding a woman's capabilities (B18), which entail lower expectations for female leaders to excel in their roles, are validated as the 8th most significant barrier.

Contrastingly, the adverse image of the construction sector and its macho culture, along with a lack of awareness about career opportunities (B1), were perceived to have minimal impact on participants' entry and progression within the sector. The absence of knowledge about career opportunities (B2) ranked lowest in terms of importance. This corroborates findings that personal experiences of respondents or those of close family members in the construction sector significantly influence perceptions of the sector and its associated fields [80]. Based on participants' experiences and perceptions of the Jordanian construction sector, it becomes evident that negative perceptions have less of an impact on women within the sector.

5.1. ISM Model

The ISM approach is a suitable technique that can be used for ranking the critical barriers that women face in gaining leadership positions in the Jordanian construction sector, as well as identifying the interrelationships between these barriers. Thus, the focus group agreed to consider twenty barriers that scored over 60% SI in the survey questionnaire for developing the ISM model; namely, all the barriers highlighted in "code2 column with Bold Text" in Table 3. Experts in the focus group discussed the interrelationship between barriers and formulated the Structural Self-Interaction Matrix (SSIM).

5.1.1. Formation of Structural Self-Interaction Matrix (SSIM)

Creating the SSIM is the first step in developing the ISM model (Table 4). The SSIM presents the pairwise relationship among the barriers of women to having leadership positions. Thus, four symbols are used to explain the relationship between barriers i and j, as follows:

V: Barrier i influences barrier j
A: Barrier j influences barrier i
X: Barriers i and j influence each other
O: There is no relation between barriers i and j.

Table 4. Structural Self-Interaction Matrix results.

	B12	**B10**	**B11**	**B25**	**B24**	**B13**	**B4**	**B9**	**B20**	**B23**	**B26**	**B29**	**B6**	**B21**	**B28**	**B31**	**B8**	**B32**	**B35**	**B14**
B12	X	V	X	A	A	V	A	V	A	O	A	O	O	O	O	O	O	O	A	O
B10		X	A	A	A	A	X	X	A	X	O	O	O	O	O	A	X	A	A	O
B11			X	X	X	V	A	V	A	A	O	O	O	O	O	O	O	X	A	O
B25				X	A	V	O	V	V	X	V	O	V	O	O	X	V	O	O	O
B24					X	V	O	V	X	X	V	O	O	O	O	V	V	O	V	O
B13						X	A	X	A	O	A	V	A	A	A	X	X	X	X	X
B4							X	X	A	X	V	O	V	O	O	V	V	V	V	V
B9								X	A	A	X	O	O	A	A	A	A	A	A	A
B20									X	X	V	V	V	X	O	V	O	X	A	V
B23										X	X	V	V	O	O	V	V	V	A	O
B26											X	V	V	O	V	V	V	V	V	V
B29												X	X	O	X	A	V	O	O	X
B6													X	X	X	X	A	A	A	X
B21														X	V	O	O	O	A	V
B28															X	X	A	A	A	A
B31																X	X	A	A	X
B8																	X	A	A	O
B32																		X	X	O
B35																			X	V
B14																				X

In this stage, the transitivity of barriers is checked between barriers. "Transitivity" means that there is an indirect relation between A and C if there is a direct relation between A and B and between B and C. Therefore, transitivity was checked during the formulation of SSIM.

5.1.2. Formation of Reachability Matrix

In the next step, the Reachability Matrix (Table 5) was developed based on the outcomes of SSIM by transforming each cell to a binary digit, 0 or 1, as follows:

1. If the cell (i, j) has 'V', then it will change to '1′, and the cell (j, i) is converted to 0.
2. If the cell (i, j) has 'A', then it will change to '0′, and the cell (j, i) is converted to '1′.
3. If the cell (i, j) has 'X', then it will change to '1′, and the cell (j, i) is converted to '1′.
4. If the cell (i, j) has 'O', it will change to '0', and the cell (j, i) is converted to '0'.

In the next step, the interaction between the reachability set and antecedents set for the barriers were constructed based on the results of the reachability matrix. This step determines the level of the barrier that obstructs women from gaining leadership positions. The barriers at the bottom level will not drive other barriers, so once they are identified, they are not included in the next hierarchy analysis. The process is iterated until the determined levels of 20 barriers are identified. The process of identifying levels is completed in eleven iterations. The final levels of main barriers are shown in Table 6.

Table 5. Reachability Matrix results.

	B12	**B10**	**B11**	**B25**	**B24**	**B13**	**B4**	**B9**	**B20**	**B23**	**B26**	**B29**	**B6**	**B21**	**B28**	**B31**	**B8**	**B32**	**B35**	**B14**
B12	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
B10	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0
B11	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0
B25	1	1	1	1	0	1	0	1	1	1	1	0	1	0	0	1	1	0	0	0
B24	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	1	0	1	0
B13	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	1	1	1	1	1
B4	1	1	1	0	0	1	1	1	0	1	1	0	1	0	0	1	1	1	1	1
B9	0	1	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0
B20	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1
B23	0	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	0	0
B26	1	0	0	0	0	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1
B29	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1
B6	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	0	0	0	1
B21	0	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	0	0	0	1
B28	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	1	0	0	0	0
B31	0	1	0	1	0	1	0	1	0	0	0	1	1	0	1	1	1	0	0	1
B8	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	1	0	0	0
B32	0	1	1	0	0	1	0	1	1	0	0	0	1	0	1	1	1	1	1	0
B35	1	1	1	0	0	1	0	1	1	1	0	0	1	1	1	1	1	1	1	1
B14	0	0	0	0	0	1	0	1	0	0	0	1	1	0	1	1	0	0	0	1

Table 6. The final levels of main barriers after eleven iterations.

Level	**Barrier**	**Description**
1	B15	Unavailability of childcare programs
2	B12	The construction sector does not have flexible work hours
	B16	Societal roles and cultural beliefs
	B4	Male-dominated culture
	B25	Lack of appropriate sanitary facilities at construction sites
	B7	Lack of organisational support
3	B31	Construction constructions involve harsh working conditions and long working hours
	B26	Construction constructions are stressful and demanding
	B32	Lack of proper recruitment practices
	B28	Lack of encouragement from supervisors
4	B10	Hostile work environment, site conditions, physical strength
5	B5	The construction sector is very conflictive
6	B11	Difficult to combine work and family life
7	B21	Lack of recognition of women's contributions
8	B14	Women taking a break in their career
9	B30	Women have greater difficulty controlling subordinates than men
10	B33	Personal female attributes
	B8	Sexual harassment
	B9	Women have to adopt male attitudes to be accepted in the sector
11	B36	Informal networks formed by men

Figure 1 shows the hierarchy of barriers that obstruct women from gaining leadership positions in the Jordanian construction sector. The obtained results show the distribution of 20 critical barriers over 11 levels. Thus, to improve the participation of women in leadership roles within construction, the first step requires solving challenges related to the barriers at the bottom level, level 1. Based on that, ensuring the availability of childcare programmes will significantly improve women's contribution, while the unavailability of childcare programmes (B15) ranked at level 1, which is considered the weakest barrier. The next step focuses on solving problems related to five barriers: the construction sector needs to improve its flexible work hours (B12), societal roles and cultural beliefs (B16), male-dominated culture (B4), lack of appropriate sanitary facilities at construction sites (B25), and lack of organisational support (B7). Therefore, the societal roles and cultural beliefs (B4) barriers are considered the significant barrier at level 2, which means that alleviating problems related to it will have a positive effect on reducing problems of other barriers in the same level. The third level includes barriers such as being stressful and demanding (B26), which create harsh working conditions and long working hours (B31) and lead to a lack of encouragement from supervisors (B28), as well as a lack of proper recruitment practices (B32). Thus, solving the problems related to the nature of stressful construction projects will have a positive effect on enhancing the work environment, the efficient contribution of supervisors, and the development of effective recruitment policies.

The fourth level up to the ninth level includes only a single barrier at each level. The hostile work environment, site conditions, and physical strength (B10) are ranked at level 4. Thus, adopting modern technologies and practices will significantly push women to have leadership positions. The barrier (B5) that is related to the conflictive nature of the construction sector is placed at level 5. This means that to improve the participation of women in leadership positions, it is essential to alleviate conflicts through improving communication between stakeholders and adopting modern methods of construction. Difficulty in combining work and family life (B11), lack of recognition of women's contributions (B21), women taking a break in their career (B14), and women having greater difficulty controlling subordinates than men (B30) are placed at the sixth, seventh, eighth, and ninth levels, respectively. Therefore, enhancing the contribution of women to leadership roles starts with improving the balance of time between work and family, which can be improved by implementing flexible working hours and off-site working. The tenth level includes three barriers: women having to adopt male attitudes to be accepted in the sector (B9), sexual harassment (B8), and personal female attributes (B33). These barriers are linked with the top level, which includes a single barrier: informal networks formed by men (B36). This barrier has the greatest effect on enhancing the participation of women in leadership positions in the Jordanian construction sector.

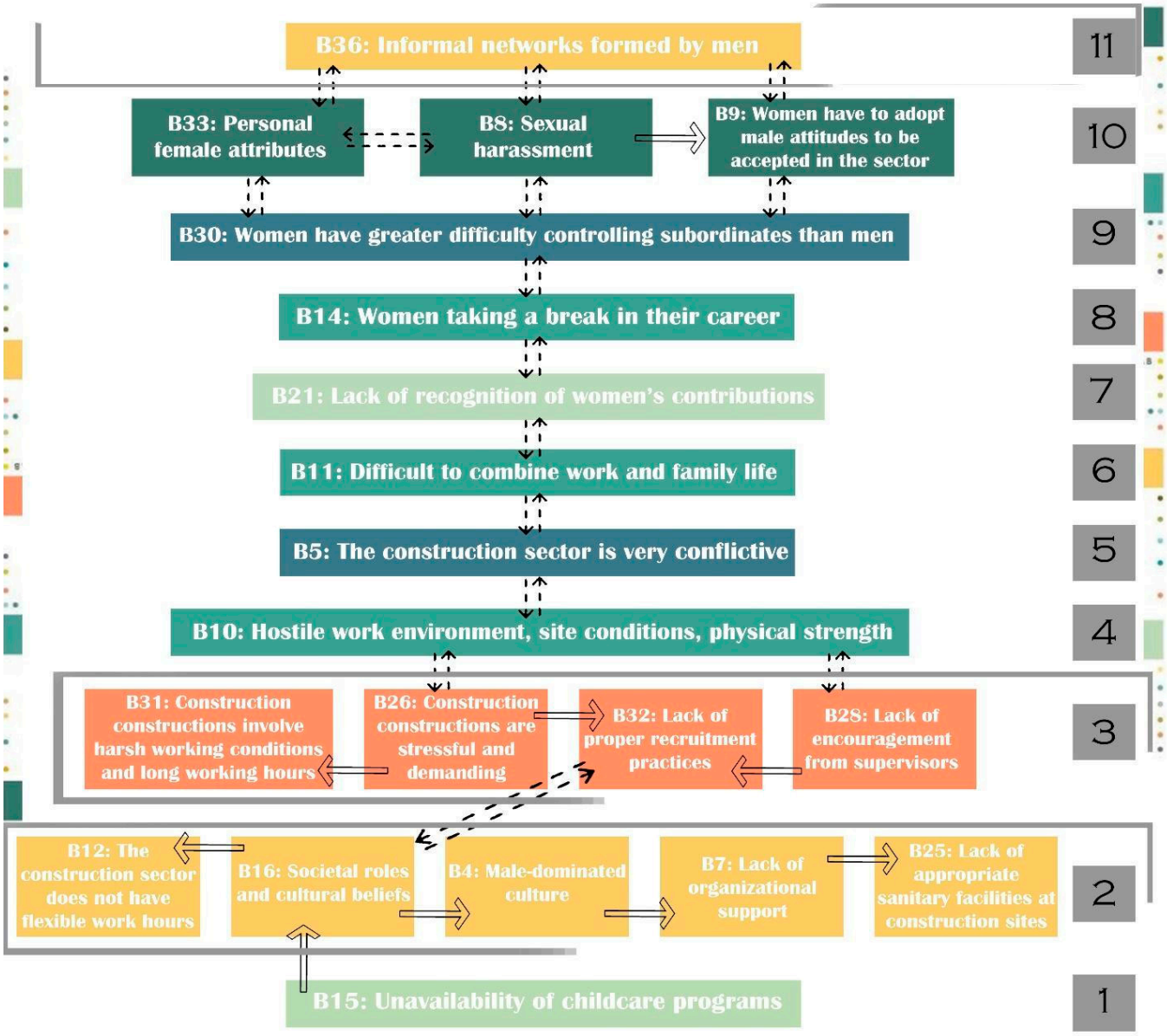

Figure 1. Structural modelling (ISM)-based model for the critical barriers faced by women in gaining leadership roles in the Jordanian construction sector.

6. Discussion

The literature underscores the pervasive nature of gender inequality and the scarcity of women in leadership positions across the global construction industry. In recent years, there has been a significant upsurge in scholarly investigations aimed at pinpointing obstacles impeding the progress of women in diverse professional settings [81]. This surge in research endeavours can be attributed to heightened societal consciousness regarding gender bias, amplified governmental efforts to tackle gender disparities, and intensified scrutiny of industries predominantly dominated by men—particularly to address the United Nations' Sustainable Development Goal (SDG) 5 on gender equality.

This study offers a timely examination of the dearth of women in leadership positions within the Jordanian construction industry, specifically focusing on architects and civil engineers. Through a comprehensive review of the available literature, it was observed that there is a paucity of research pertaining to the Jordanian construction sector. To address this gap, an extensive systematic literature review (SLR) was conducted to identify barriers faced by women seeking leadership roles in the Jordanian construction industry. The SLR

identified 36 distinct barriers that could impede women from ascending to leadership positions. These findings served as the foundation for the development of questionnaires distributed across the Jordanian construction industry. The Severity Index formula was employed to rank these barriers based on responses obtained from 419 participants. It is imperative to acknowledge and understand the primary barriers and their respective significance to effectively address and eliminate them [82].

The findings of this study underscored differing perceptions of barriers faced by women in the construction sector among their colleagues. Notably, female respondents identified the unavailability of childcare programmes (B15) as a significant barrier, ranking it as the primary obstacle, while male respondents ranked it as 12th, citing the extensive availability of nurseries in Jordan as mitigating this barrier's significance. The study highlighted that maintaining a healthy work–life balance (B2) was identified as the foremost critical barrier hindering women from attaining leadership roles. In Arabic countries like Jordan, women often shoulder significant family responsibilities, including childcare and communal duties within extended family networks. Balancing these responsibilities can lead to various health-related challenges and significant stress, which can impact workplace performance. The study found that women who received support from their families were better able to advance their careers, but they also needed to continuously develop their leadership skills to maintain this balance. This was corroborated by women's responses to B8, lack of family support, in the questionnaire study. As a result, the significant involvement of men in family responsibilities in Jordan has enabled women to receive essential support from their families, making this barrier less critical.

The results revealed that only seven barriers had a Severity Index exceeding 70.0%, indicating their significance in the Jordanian context. These barriers include the unavailability of childcare programmes (B15), difficulty in combining work and family life (B11), lack of flexible work hours in the construction sector (B12), harsh working conditions and long hours (B31), stressful and demanding nature of construction work (B26), women taking breaks in their careers (B14), and societal roles and cultural beliefs (B16).

Subsequently, the Interpretive Structural Modelling (ISM) model hierarchically ranked twenty barriers with a Severity Index of more than 60.0% as critical barriers, according to focus group discussions, hindering women from attaining leadership roles. These barriers were distributed over eleven levels, with level 1 comprising the weakest barriers and level 11 encompassing the strongest ones. The study identified ten significant barriers and drivers spanning levels 10 and 11, requiring special attention from decision-makers in the Jordanian construction sector. These barriers included interdependent factors related to the disadvantages faced by women, such as personal female attributes (B33), the expectation for women to adopt male attitudes for acceptance in the sector (B9), and exposure to sexual harassment (B8). The top-level barrier, informal networks formed by men (B36), was identified as having the greatest influence on enhancing women's participation in leadership positions in the Jordanian construction sector. These barriers are influenced by lower-level barriers and, in turn, impact other barriers in the study model. Thus, achieving gender equality in the construction sector involves addressing gender disparity aspects, alleviating challenges at level 1, and subsequently addressing issues related to the second level and beyond.

7. Conclusions

The underrepresentation of women in leadership positions within the construction sector is a widespread issue, and Jordan is no exception to this global phenomenon. Consequently, the research study aimed to identify the primary obstacles encountered by qualified women as they strive to ascend to leadership roles in the Jordanian construction sector. Initially, a total of 36 barriers were discerned through a thematic analysis of previous contributions. These barriers served as the basis for a questionnaire distributed online across the Jordanian construction sector, garnering responses from 419 engineers.

The results of the Severity Index (SI) analysis highlighted the significant recognition of challenges related to balancing motherhood and family responsibilities with professional obligations. Particularly, respondents overwhelmingly agreed on the demanding nature of working conditions and long hours prevalent in the construction sector and its affiliated fields. Notable perceptual disparities were identified, with women expressing significant concerns regarding potential hierarchical setbacks associated with maternity leave, as well as the absence of flexible work schedules, childcare provisions, or accommodations for career breaks. Concurrently, men acknowledged the existence of a macho culture in the workplace, indicative of traditionally male-dominated fields where women's perspectives may be overlooked or disregarded.

The study underscores the necessity of developing strategies that actively promote women's involvement on their own terms, facilitating empowerment processes and offering viable means to address and ameliorate existing challenges. Consequently, the Interpretive Structural Modelling (ISM) model categorised 20 critical barriers across 11 levels, with level 1 comprising the least formidable barriers and level 11 encompassing the most formidable ones.

The findings revealed that the lack of childcare programmes emerged as a primary barrier, positioned at the initial level, suggesting that it can be addressed relatively straightforwardly. Addressing challenges associated with barriers at level 1 is expected to have a cascading effect, facilitating the resolution of subsequent barriers at higher levels. Ultimately, the ISM analysis highlighted the predominant barrier to be the entrenched male culture in the workplace. This encompasses not only informal networks formed by men but also other impediments stemming from the inherent disadvantages faced by women in such a macho environment. In this setting, women may find themselves compelled to adopt masculine traits to conform to workplace norms, thereby hindering their advancement and perpetuating gender disparities in the construction sector.

Ultimately, this research is subject to a notable limitation, as its findings are specific to the context of Jordan. Thus, future research endeavours should encompass Middle Eastern nations and other developing countries to offer a comprehensive understanding of women's contributions to leadership positions in the construction sector across the MENA (Middle East and North Africa) region.

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