

## Mapping gendered inequalities in a male-dominated industry: A scientometric analysis of research on women in construction

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<https://doi.org/10.31462/jcemi.2026.640>

Received 20 November 2025; Revised 08 April 2026; Accepted 13 April 2026; Available online 22 June 2026

### Keywords

Construction industry  
Gender equality  
Women workforce  
Gender discrimination  
Scientometric analysis  
Bibliometric analysis

### Abstract

The aim of the current study is to carry out a scientometric analysis of academic research investigating gender-based barriers encountered by women employed in the construction industry and to identify gaps in the literature. In this context, 214 publications indexed in the Web of Science (WoS) database were identified using bibliometric methods and analyzed using scientometric methods. The findings demonstrated a steady increase in publication trends over time. The literature was structured around themes of gender discrimination, sexism, women in construction, culture, and work-life integration. The findings showed that while country-specific studies were common, comparative and multi-contextual analyses remained limited. The results indicate that research has primarily focused on barriers and constraints. Studies on women's career advancement, resilience, and experiences of success were relatively scarce. Overall, this study maps key research trends, identifies gaps in the existing literature, and offers directions for future research to develop a more comprehensive understanding of gender inequalities in the construction industry.

### 1. Introduction

The construction industry is one of the most significant contributors to global economic growth and development. Despite its critical importance, the construction industry sustains to struggle with entrenched gender inequality. Industries with less than 25% women's workforce participation are known as male-dominated sectors [1]. For example, as reported by the US Census Bureau, women's representation in the construction industry in the US is 11% [2, 3]. Women comprise only 9% of the European construction workforce [4] and 18.5% of the Australian construction industry [5].

In the construction industry, a historically male-dominated field, women's participation in the workforce is constrained, and female employees frequently encounter gender discrimination [6, 7]. Female employees may face many obstacles in the construction industry due to gender discrimination, such as wage discrimination, career advancement barriers, gender-based prejudices, discriminatory behavior, and harassment [8-15]. In addition, the physical and cultural structures of working environments in the construction industry create significant barriers for women employees to gain a long-term place in the industry

[16]. In this context, discrimination in the construction industry negatively impacts not only the individual experiences of women but also the productivity and innovation capacity of organizations [17]. The occupational categories in which women participate in the construction industry vary culturally. Women mainly have technical roles, including engineering, architecture, project management, and occupational health and safety. Additionally, they often hold supportive positions in human resources, quality control, and office management [5, 18, 19]. The number of women employed in direct roles within construction sites is relatively minimal [17, 20]. Women are engaged in various roles within the construction industry in different geographical areas, including apprenticeships, artisanry, and manual labor [21-24].

Women in the construction industry encounter gender-based challenges irrespective of their occupational role or hierarchical position. Existing academic research in this field has predominantly concentrated on cultural and geographical determinants. The studies addressed the subject geographically, specifically for Afghanistan [25]; Australia [5, 18, 26-39]; Bangladesh [23, 40]; Bosnia and Herzegovina [41]; Chile [42-44]; China [45]; Colombia [46]; France [47, 48]; Ghana [22, 49, 50]; India [9, 24, 51-55]; Jordan [16];

Malaysia [56, 57]; Mexican [58]; New Zealand [59-62]; Nigeria [21, 63-66]; Palestine [67]; Peru [68]; Saudi Arabia [69]; Singapore [70]; South Africa [13, 71-76]; Spain [20, 48, 77-82]; Swedish [83]; Tanzania [84]; Thailand [40]; Turkey [85-88]; UK [15, 47, 48, 89-97]; US [88, 98-100]; Yemen [101].

Some studies have examined the gender-related challenges faced by qualified female professionals, including civil engineers and architects (e.g. [15, 16, 20, 25, 31, 39, 49, 54, 67-69, 74, 75, 81, 86, 87, 101, 102]). Numerous studies have explored the gender-related barriers encountered by women professionals serving as consultants, leaders, entrepreneurs, CEOs, and managers within the construction industry (e.g. [28, 34, 37, 38, 40, 46, 50, 56, 57, 63, 64, 66, 70, 77, 83, 84, 89, 91-94, 98, 99]). Some studies have been conducted that examine female students' career choices, inclinations toward the construction industry, and career barriers (e.g. [33, 44, 71, 73, 79, 80, 85, 88, 103]). In summary, academic studies on gender equality in the construction industry indicate significant structural problems in the industry. Globally, the construction industry remains male-dominated [64].

The main objective of this study is to systematically analyze the structure, development, and thematic evolution of the literature on gender inequality faced by women in the construction industry using bibliometric and scientometric methods. Accordingly, this study aims to map current research trends, identify gaps in the literature, and reveal future research opportunities. The study seeks to answer the following research questions:

RQ1: What is the temporal and quantitative development of academic publications on gender inequality against women in the construction industry?

RQ2: Which themes, concepts, and research clusters have become dominant in the literature in this field?

RQ3: What is the geographical and institutional distribution of research on women in the construction industry?

RQ4: What thematic gaps exist in the current literature, and what new trends emerge for future research?

This study distinguishes itself from previous research with its up-to-date dataset and scientometric approach. It reveals that the barriers women face in the construction industry are not only sociological issues but also a problem of construction management. By identifying dominant themes and emerging research gaps, the study provides a knowledge base to inform inclusive management strategies and future research design.

### 1.1. Existing studies and gaps in the literature

In recent years, there has been a growing number of systematic reviews, state-of-the-art, and scientometric analyses of gender inequality faced by women in the construction industry. These studies address themes such as diversity, equality and inclusion, career development, mental health, occupational health and safety, and women's

entrepreneurship, discussing women's experiences in a male-dominated industry in a multidimensional way.

Studies in the literature evaluate the architecture, engineering, and construction industry along various axes. Ghanbaripour et al. [30] systematically analyzed, within the Australian context, why women are underrepresented in the construction industry and why they leave it, by examining studies conducted over the past 30 years up to the year of their research. Naoum et al. [93] comparatively examined the self-perceptions and career development of women and men working in construction consulting firms in the UK through a literature review and survey. Heydari et al. [104] identified the barriers faced by women and homosexual individuals in the US construction industry through a systematic literature review. Bridges et al. [105] presented a systematic literature review of 26 articles published between 1998 and 2019 that examined the recruitment and retention rates of women in skilled jobs. Navarro-Astor et al. [106] systematically reviewed the literature from 2000 to 2015 to identify the barriers women face in the construction industry and synthesize effective strategies to strengthen their careers. These studies are mostly limited to specific countries, occupational groups, and time periods.

Another set of research includes systematic and scientometric reviews addressing issues related to women's mental health, occupational health, and safety. Rotimi et al. [107] conducted a systematic literature review of 27 studies between 2010 and 2021 to identify factors affecting the mental health of women working in the construction industry. Mariam et al. [108] analyzed trends in the health and safety of women in the construction industry using scientometric and meta-analytic methods, based solely on research papers as of the end of 2019. While these studies are essential references focusing on health-related barriers, some time has passed since their publication.

Another set of research areas includes state-of-the-art assessments and review studies. Sospeter et al. [84] presented the first phase of a two-stage study analyzing the reasons for the underrepresentation of women entrepreneurs in the Tanzanian construction industry and the gaps in the literature in this area. A final model based on the data collected in this phase was left for the second phase of the study. Araya et al. [109] identified the barriers women face in the construction industry through a systematic literature review and discussed these findings by comparing them to the specific situation in Chile. The studies mentioned examine in detail country-specific structural and cultural factors. They are national in scope.

Hasan et al. [110] analyzed the global academic literature on gender inequality and discrimination using scientometric methods. This study, which examined 128 research papers published between 2000 and 2019, was published some time ago.

This study comprehensively analyzes the evolution of the literature on gender inequality against women in the

construction industry, using a current, global dataset from the WoS database. To ensure the broadest possible scope of the research and a holistic representation of the body of knowledge in the field, all relevant studies published up to the date of the review were included in the analysis. To ensure diversity in publication types and to cover different presentation formats in the literature, all publication types, including articles, reviews, proceeding papers, and book chapters, have been included in the study. This approach makes emerging research areas visible and offers a unique, holistic framework to guide future research on gender inequalities in the construction industry.

## 2. Methodology

Aiming to meet the stated research goals, bibliometric and scientometric approaches were jointly employed. While the terms scientometric analysis and bibliometric analysis are often used interchangeably in the literature, bibliometric analysis is one of the tools within the broader scope of scientometric analysis. While scientometric analysis focuses on understanding science's general dynamics and systematic structure, bibliometric analysis is a subset of scientometric analysis and provides numerical data for it. In other words, all bibliometric studies can fall under the scope of scientometrics, but not all scientometric studies are exclusively bibliometric. While bibliometric analysis answers the questions "How many publications are there?" and "Who publishes?", scientometric analysis addresses the questions "How effective are these publications?" and "How are scientific production and collaboration developing?".

### 2.1. Data collection

Bibliometric data for the study was collected from the WoS database. This is because WoS covers more of the studies in the natural sciences and engineering fields [111]. The WoS search involved a three-level search. The first level focused on the keyword "construction industry" and its alternatives, while the second level focused on the keyword "woman" and its alternatives. The third level employed "gender discrimination" and various related keywords. The search query is shown in Fig. 1.

WoS's TS= search algorithm incorporates the capability for searching for keywords enclosed in quotation marks in the following categories: publication title, publication abstract, author-supplied keywords, and keywords plus [112]. Search operators such as OR and AND were used to expand or narrow searches [113]. The AND operator separates each level in a three-level search query. The AND operator finds all records separated by this operator. The OR operator separates alternative keywords within each level. The function of OR operator is to identify records that contain one or more of the search expressions. The asterisk (\*) wildcard

substitutes for zero or more characters [114, 115]. For instance, the keyword "opportuni\*" in the search query in Fig. 1 lists all publications containing the words "opportunity", "opportunities", and "opportunistic" in the publication title, publication abstract, author-supplied keywords, and keywords plus. Using the asterisk wildcard allows a more comprehensive search to be performed and all publications related to the subject are included in the review [116].

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart was utilized during the stages of inclusion and exclusion. The PRISMA flowchart is a standard visual tool employed in the reporting process of systematic reviews and meta-analyses [117]. This flowchart provides a comprehensive and transparent overview of the selection process used in the literature review [118].

The PRISMA flow chart in Fig. 1 clearly shows how the publications for which information was collected were selected and why they were excluded during the data collection process.

The following criteria were established for publications to be included in the study within the scope of the three-stage search strategy shown in Fig. 1: The publication must be indexed in the WoS database, published in English, be a research article, review article, book chapter, or proceeding paper, and the specified search terms must be included in the publication title, publication abstract, author-supplied keywords, and keywords plus.

The criteria for publications excluded from the study are as follows: Studies published in a language other than English, publications that do not include search terms in the publication title, publication abstract, author-supplied keywords, keywords plus, and studies that, even if they include search terms, are not directly related to the purpose of the research in terms of content and scope, were excluded from evaluation.

The inclusion-exclusion process, carried out in accordance with these criteria, ensured that the study's scope was determined systematically, transparently, and reproducibly. The WoS search was conducted manually on September 8, 2025, and yielded 471 publications.

In the initial screening phase, the titles and author-supplied keywords of all publications were examined individually; publications not directly related to the research scope were excluded. In the second stage, the remaining publications' abstracts were evaluated in detail, and those that did not align with the research context were eliminated. In the final stage, the full texts of publications that appeared suitable were reviewed. Publications that did not contain gender discrimination or were not directly related to women in the construction industry were excluded. As a result of this elimination process, a total of 214 publications, including 180 articles, 16 proceedings papers, 11 review articles, and 7 book chapters, were collected.

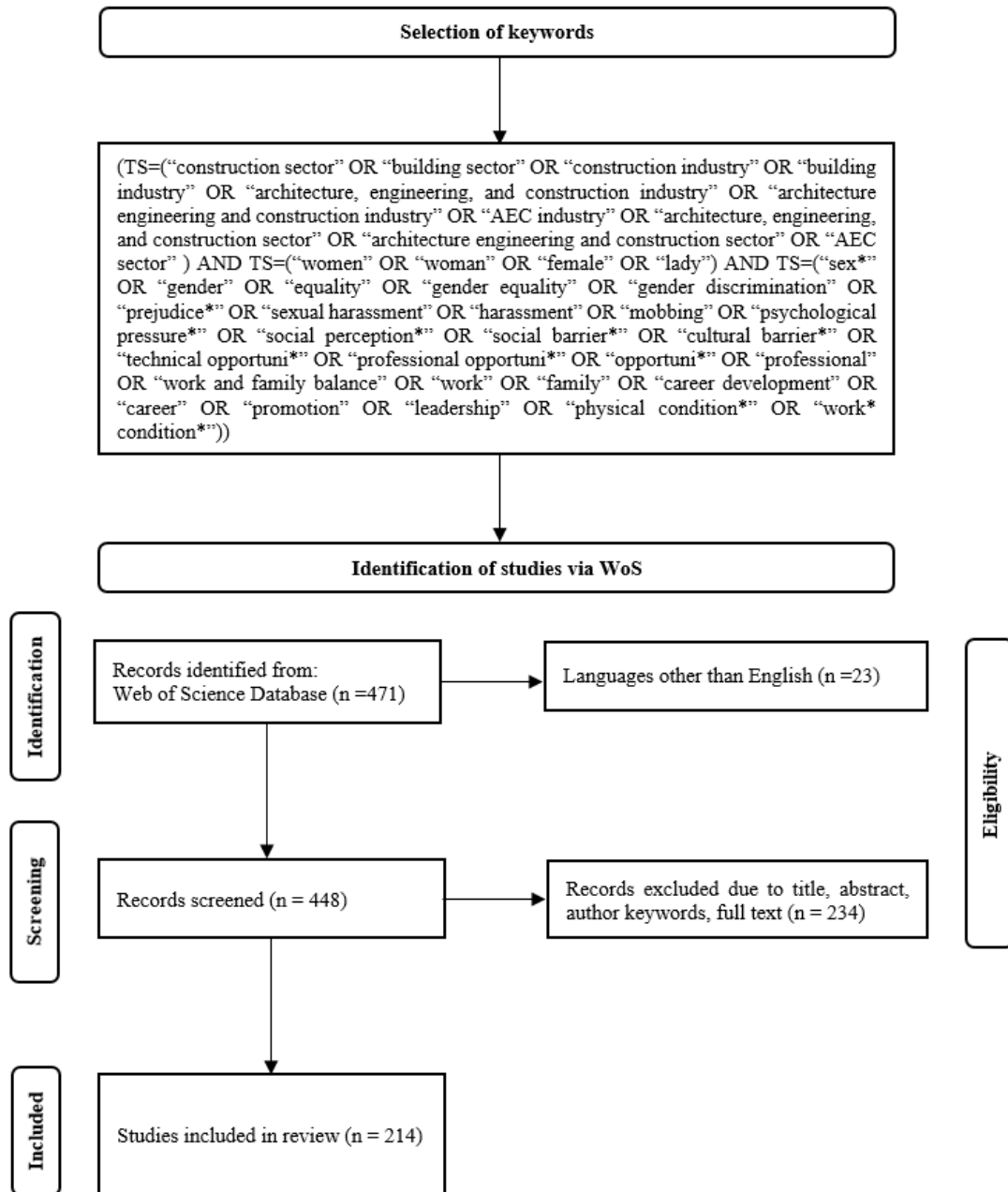


Fig. 1. The PRISMA flow chart of the bibliometric analysis stage

## 2.2. Data analysis

During the data collection phase, scientometric analysis was conducted on the collected bibliometric data. Many software programs can be used in scientometric analysis. The most commonly used tools include Bibliometrix, VOSviewer, Gephi, CiteSpace, HistCite, and Sci2 [119]. In this research, the Bibliometrix software was chosen for the analysis.

The main reason Bibliometrix was chosen is that it enables end-to-end, transparent, and repeatable execution of all stages of the bibliometric analysis process. Thanks to its R-based, open-source nature, data cleaning, descriptive statistics, citation analysis, co-authorship networks, keyword co-occurrence analyses, conceptual structure maps, and thematic evolution analyses can be performed within a single, holistic framework [120, 121]. Bibliometrix offers a significant

advantage in highly multidisciplinary, conceptually diverse research areas such as gender inequality and the construction industry, through its advanced functions, including thematic analysis, factorial analysis, and time-dependent trend analysis. Furthermore, the software's ability to work directly with raw data enables the reproduction of all steps in the analysis process, increasing methodological transparency [122].

Publication information from the WoS database was exported to BibTeX Document (.bib) format. Text mining and visual mapping were performed using the R-based Bibliometrix software. The findings are presented in the next section.

### 3. Finding and Discussion

The publication trend from 1996 to the present is illustrated in Fig. 2. The study shows that academic interest in the subject increased significantly, particularly between 2020 and 2025, peaking in 2024. This trend can be attributed to policy tools and regulations implemented in some countries to encourage women's participation in the construction industry.

Another reason for the observed increase in research on this topic after 2020 is that gender equality has become a priority within sustainability agendas. Sustainable Development Goal 5 (SDG), one of the 17 SDGs outlined in the 2030 Sustainable Development Agenda adopted at the 2015 United Nations Summit on Sustainable Development, focuses directly on eliminating gender-based inequalities with the aim of "Achieve gender equality and empower all women and girls" [123]. The fact that the first sub-goal of SDG 5 is defined as "ending all forms of discrimination against women and girls" [124] has provided an essential frame of reference for increasing academic interest in gender discrimination.

Another critical element supporting this global trend is the principle of equality emphasized in the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) [125]. According to CEDAW, achieving legal equality between women and men does not, in itself, mean that social and structural inequalities have been eliminated. The convention views the elimination of prejudices, traditional practices, and stereotyped roles that lead to discrimination against women as a responsibility of states. This approach has helped make the problems faced by women in male-dominated industries, such as construction, more visible and more frequently addressed in academic studies.

Therefore, the increase in studies on women and gender inequalities in the construction industry can be seen as a natural consequence of sustainability goals, international

conventions, and equality-focused policies that have shaped research topics. Indeed, the SDGs covering the period 2015-2030 directly address issues such as access to work, discrimination, and the pay gap [39], and this framework is seen to encourage academic production.

As shown in Fig. 2, gender inequality faced by women in the construction industry is a dynamic and rapidly expanding area of research. Academic output in this field is expected to continue increasing in the coming years.

Fig. 3 illustrates the relevant categories of WoS. The text on the columns indicates the rate and record count, respectively. According to the figure, the category with the highest volume of research is "Engineering Civil", accounting for 34.1% of the total and comprising 73 records. The "Management" category, for instance, has 52 record counts, yielding a 24.3% rate. Similarly, the "Construction Building Technology" category has 45 record counts, resulting in a 21% rate. Due to the inclusion of a study in multiple categories, the total number of publications may exceed the number included in the review, which is 214. Furthermore, it is worth noting that rounding may result in slight discrepancies, with percentages potentially exceeding 100%.

Upon analyzing the countries represented in the publications reviewed, it was observed that 34 different countries contributed to the problem of gender discrimination in the construction industry. The countries that contributed the most are Australia (19.40%), UK (17.35%), USA (15.93%), Spain (8.36%) and South Africa (8.36%). The conclusion drawn from this is that the topic has received more attention and study in the Western world. In fact, considering the cultural structures of various regions worldwide, women's social participation is relatively lower in the East than in the West. However, research indicates that the gender-related challenges encountered by women working in the construction industry are universally observed across a range of regions and cultures.

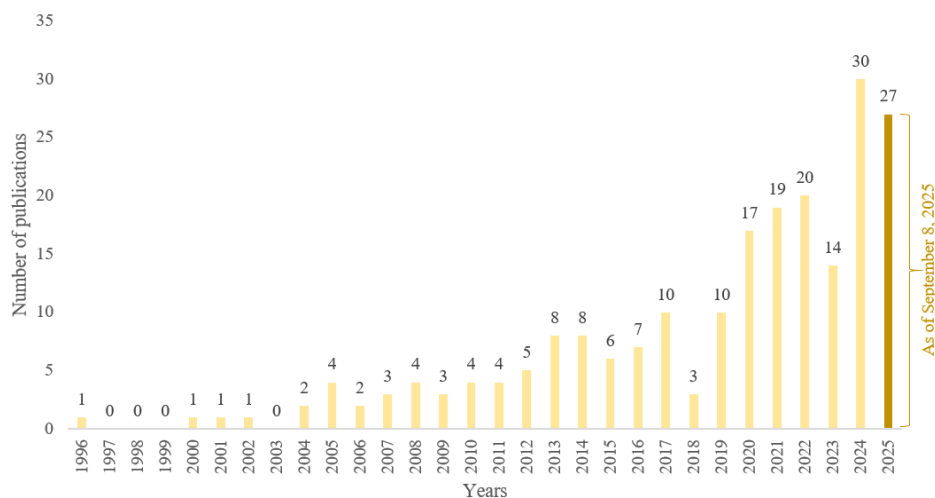


Fig. 2. Annual scientific production of publications

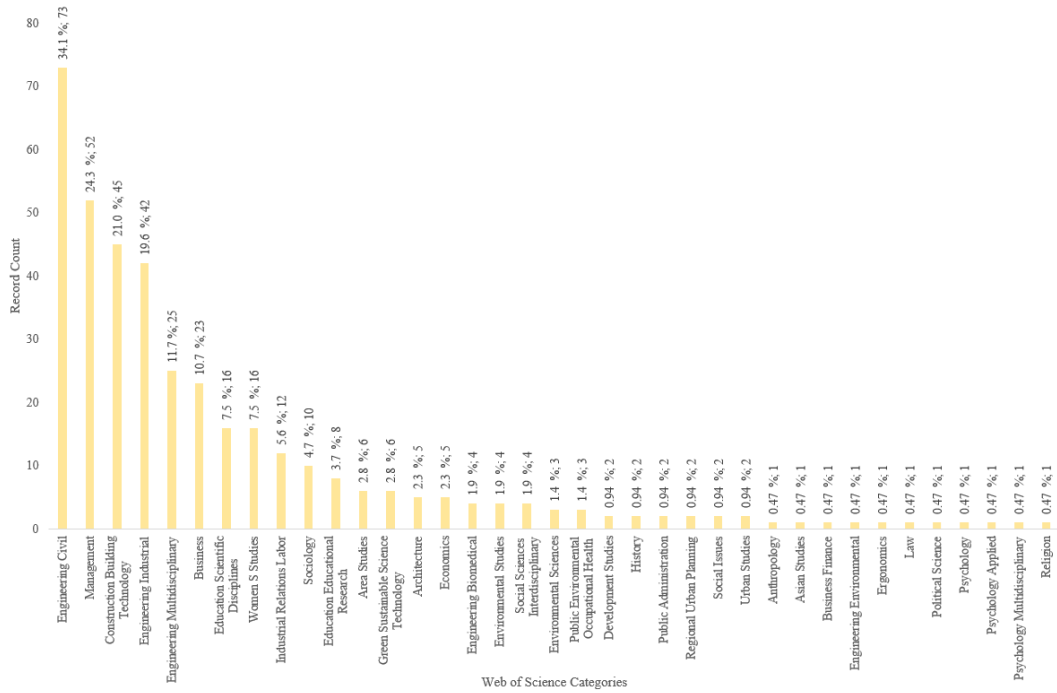


Fig. 3. Relevant categories of WoS

Fig. 4 illustrates a three-field plot derived from the Sankey diagram. The figure is connected by flow lines that show which authors (left column), in which countries (middle column), and at which universities (right column) published.

The three-field plot reveals that prominent scholars, including Elena Navarro-Astor, Margarita Infante-Perea, Qingbin Ciu, Paul J. Hickey, and Riza Y. Sunindijo, have publications primarily based in Australia, Spain, the UK, and the USA. The authors have also engaged in collaborative endeavors with institutions based in countries other than their own.

An examination of country-university relations reveals notable institutions such as the “Queensland University of Technology”, the “University of New South Wales”, and the “University of Sydney” in Australia; the “Polytechnic University of Madrid”, the “University of Seville”, and the

“Polytechnic University of Valencia” in Spain; and the “University of Westminster” and “Nottingham Trent University” in the UK.

The three-field plot is an effective tool for understanding collaborations between researchers and institutions across geographical boundaries, as well as which universities are more active internationally.

Fig. 5 presents a word cloud that illustrates the authors’ primary keywords. The use of word clouds helps explain the most frequently studied areas [126]. The font size of the words in the word cloud increases according to the frequency of use of the keywords by the authors. For instance, the term “construction industry” was used 71 times by the authors of 214 publications, “women” 61 times, “gender” 57 times, “diversity” 19 times, “women in construction” 13 times, “equality” 7 times, and “career barriers” 4 times.

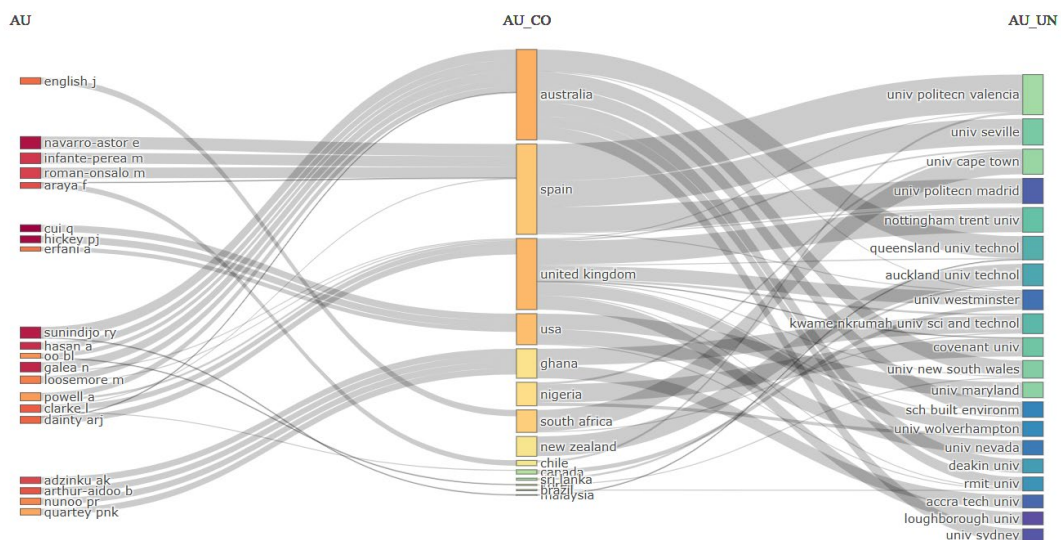


Fig. 4. Three field plot of 214 publications



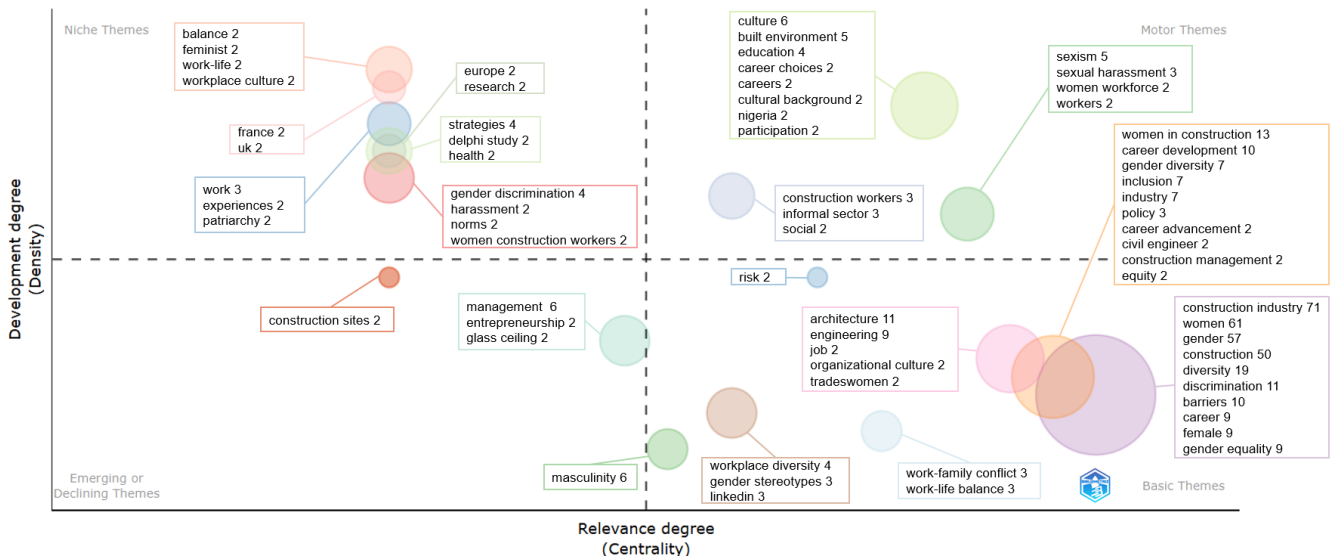


Fig. 7. Thematic map based on authors' keywords

In this study, the minimum cluster frequency was set to three during the creation of the thematic map. This was done to ensure the visibility of small clusters and to capture niche and new topics. The minimum cluster frequency is defined as the minimum number of keywords a theme (cluster) must contain to be displayed on the map. The numbers next to the keywords on the thematic map are the occurrence numbers of the keywords.

The comprehensive thematic map analysis revealed that research trends within the literature have evolved across varying levels of development. Among the motor themes, themes such as “culture”, “built environment”, “education”, “sexism”, “sexual harassment” and “women workforce” are both highly central and highly dense. This indicates that these themes are at the centre of current debates and are the themes that shape the literature.

Niche themes, such as feminist approaches, social norms, discrimination, harassment, and experience-focused studies, are mature in their own right but have limited relevance to the overall literature. This suggests that these topics continue to be the focus of certain groups of researchers.

Basic themes such as “architecture”, “engineering”, “career”, “diversity”, and “construction industry” are highly central but exhibit low density. Although these themes form the foundations of the field, these concepts need to be examined in more depth.

Finally, the emerging or declining themes include “construction sites”, “entrepreneurship”, and “glass ceiling”. These themes have not yet been sufficiently developed in the literature. They may represent areas with potential for future growth or topics that are gradually losing academic interest.

Overall, the thematic map analysis indicates that issues such as culture, education, and the women workforce are prominent in the interaction between gender and the construction industry. Key areas such as architecture, engineering, and career development appear to require more academic attention.

The thematic map generated through the Walktrap clustering algorithm consists of 22 clusters and 107 distinct author keywords.

Multiple Correspondence Analysis (MCA) was applied via Bibliometrix to reveal the conceptual structure of the literature (Fig. 8). MCA was chosen because it is a suitable method for analyzing and visually presenting relationships between non-numerical data, such as keywords. This method visualizes the relationships between concepts in a low-dimensional Euclidean space [120]. It helps to define relationship patterns in the literature clearly [133].

During the analysis, the number of clusters was set to 7 to better highlight the dominant topics and sub-themes in the literature. In the map obtained from MCA, the distance between keywords reflects their relationship and centrality [120]. The map's horizontal and vertical axes statistically illustrate the key divergence points identified in the literature. The blue cluster in the center of the map, containing concepts with high factor loadings such as “sexism”, “sexual harassment” and “masculinity” comes together within the context of the “construction industry” representing the fundamental issues of the field and the core and most prevalent research themes in the literature. Negative values in MCA do not indicate weakness or absence. They represent the position of variables on the opposite side of the dimension.

The green cluster in the upper right quadrant of the map designates “career barriers” and “building engineering” as relatively specialized research streams, with a focus on “Spain”. The small clusters, colored purple and pink, respectively, indicate that the themes of “education” “employment” and “career development” are independent but relatively fragmented and expandable sub-themes in the literature. The yellow cluster in the lower right area of the map systematically groups concepts with high factor loadings: “equality”, “diversity”, and “inclusion”.



Muthambi et al. [74] and Muthambi and Agumba [75] in South Africa, Infante-Perea et al. [80], Recalde Esnoz et al. [82] in Spain; Arslan and Kivrak [85], Aydın and Erbil [86] and Koc et al. [88] in Turkey; Fernando et al. [92], Naoum et al. [93] in the UK; Lekchiri and Kamm [99], Tapia et al. [100] in the USA and Ghaleb et al. [101] in Yemen are all on this line. Sample sizes vary considerably. Some studies remain small-scale, while others reach larger groups of participants. For example, Baker et al. [18] reached 655 participants, Infante-Perea et al. [80] reached 704 students, and Recalde Esnoz et al. [82] reached 1353 participants. This indicates that the field encompasses both exploratory and descriptive research.

There are also mixed methods studies and alternative methods. However, their number is more limited. Alshdiefat et al. [16], Salazar et al. [44], Amponsah-Asante et al. [50], Chawada et al. [53] and Khurana [55] used both questionnaires and interviews. Some studies have adopted approaches that differ from the classic questionnaire-interview approach. Yan et al. [5] conducted a thematic analysis of the documents. Sospeter et al. [84] carried out a systematic literature review. Hernández-Nicolás et al. [77] used the least squares method. Oladinrin et al. [76] utilized a fuzzy synthetic evaluation method. Rotimi et al. [61] applied structural equation modeling. Wang et al. [45] statistically examined labor force data. Yan et al. [37] analyzed LinkedIn profiles using machine learning. This pattern shows that the field is beginning to expand methodologically. Nevertheless, the backbone still consists of interviews and questionnaire studies. The sample structures are also remarkably diverse. Studies include women engineers, architects, project managers, students, entrepreneurs, professionals, and artisans. However, this distribution varies from country to country. In countries such as the UK, Australia, Spain, and New Zealand, professional roles, managers, and students have been studied more frequently. In contrast, countries such as Bangladesh, India, Ghana, Nigeria, and South Africa have seen more studies on women workers and artisans. This demonstrates that methodological preferences are not merely academic choices. They are also closely related to the country's workforce, cultural context, and the visible roles of women in the industry.

Overall, the studies in the dataset are strong in revealing the barriers women face in the construction industry. However, the literature largely represents a specific region, is country-focused, and is based on problem identification. Research that tests solutions in practice appears to be more limited. Furthermore, the fragmented sample of women engineers, architects, managers, students, workers, and artisans makes it difficult to draw generalizable conclusions. Therefore, while the field is strong in identifying existing problems, it is still open to generating solutions and developing a comparative structure.

## 4. Managerial Implications, Research Trends and Future Directions

The findings of this study have implications for both practice and future research. In particular, methodological and geographical gaps identified in the existing literature necessitate the development of new management strategies for construction companies and the identification of new directions for researchers. In this context, this section first discussed the managerial implications of the results and then presented the main research trends and future directions emerging from the literature.

### 4.1. Managerial Implications

The issue of gender inequality in the construction industry is directly related to management and organization. The literature highlights sexism, harassment, career barriers, and work-life balance problems [15, 24, 75]. For example, studies have shown that women are underrepresented even in green engineering firms in Nigeria [63] and that in Spain, women face more barriers in small-scale companies, while firms investing in R&D and technology are more favorable [78]. This shows that while problems can be seen even in places with relatively high corporate awareness, they can be more visible in smaller companies. The thematic map (Fig. 7) and MCA (Fig. 8) findings of this study also show that themes such as sexism, harassment, career barriers, and the women workforce are central to the literature. The prominence of these issues is not solely dependent on women's individual experiences in the industry. This reveals that the problem has an organizational and managerial nature. Organizational culture, construction site practices, wage and promotion systems, and daily work relationships are all determining factors. Therefore, it is not enough for construction companies to approach the issue solely through the lens of diversity. Recruitment, task allocation, performance evaluation, and promotion processes need to be made more transparent, traceable, and inclusive.

The entry of women into the industry and their advancement within the industry do not equate. Studies show that while women can access professional roles, they face invisible barriers at leadership and decision-making levels. Discrimination, hostile perceptions, lack of role models, mobbing, and stressful work environments are significant barriers to retention in leadership and entrepreneurship [34, 50, 84, 99]. Although maternity leave is a legal right, there are invisible barriers, such as the perception of hierarchical loss upon returning to work after maternity leave [68, 89]. Therefore, while managers should focus on increasing women's employment, they should also aim to establish organizational mechanisms that support the women workforce in remaining in the industry. Mentoring programs, leadership development opportunities, return-to-work support after periods such as maternity leave, fair workload planning, and flexible working options are important in this regard. The UK example clearly shows that flexible working

arrangements, transparent promotion criteria, and return-to-work support are necessary for women's retention in the industry [93].

Legal equality and actual equality are not the same thing. Even in regions with relatively strong egalitarian laws, such as the EU and Australia, women continue to face underrepresentation, masculine culture, discrimination, and indirect exclusion [27, 29, 90, 95]. Therefore, organizations should not limit themselves to preparing policy documents alone. They need to implement anti-harassment procedures, establish reliable complaint mechanisms, train managers in inclusive leadership, and monitor for indirect discrimination. This is because discrimination often reflects itself in communication styles, a sense of belonging, pressure on women to prove themselves, and male-dominated workplace norms [32, 59, 61, 62, 94].

Managerial practices should be shaped according to the political, economic, socio-cultural, and institutional structures of countries. For example, even egalitarian laws in EU countries differ in practice due to differences in their political structures [47, 81]. The barriers women face in the industry do not appear with the same intensity or in the same form in every country. Indeed, the country distribution findings of this study (Fig. 4) show that research is largely country-specific. Comparative studies remain more limited.

In developing countries, childcare, family roles, and societal pressures are prominent factors [16, 25, 67], while in developed countries, long working hours, industry culture, career barriers, and access to leadership are decisive factors [18, 26, 30, 37]. Therefore, companies, professional associations, and policymakers must develop strategies that account for the needs of different groups of women. Professional women, female construction workers, female artisans, and students all belong to the industry. However, their needs differ. Therefore, inclusive management should be seen as a necessity for employee engagement, productivity, talent retention, and the sustainability of the construction industry [35, 36, 39].

#### 4.2. Research trends and future directions

An analysis of publications by year shows that studies on women and gender in the construction industry began in 1996 and increased rapidly after 2020. While early studies were limited in number, there has been a sharp increase in publications in recent years. This increase indicates that the field is now in a maturing phase. In the WoS categories, studies are predominantly concentrated among disciplines such as construction, engineering, management, social sciences, and environmental studies. It is also understood that disciplines such as sociology, economics, and social sciences are also at the forefront. This distribution reveals that the issue is addressed not only as a technical problem, but also in its organizational, managerial, and social dimensions. The interdisciplinary nature of the field also brings about conceptual diversity.

In author-country-university network analyses, studies based in Australia, Spain, the UK, and the US stand out. Universities in these countries are shaping the field. In contrast, the relatively limited representation of other geographies points to a significant gap in the literature for comparative and multi-contextual studies.

The word cloud and keyword co-occurrence network clearly reveal the conceptual core of the literature. The concepts of the construction industry, women, and gender are central. These concepts are closely linked to themes such as discrimination, diversity, leadership, career development, and inclusion. This indicates that the literature has long focused on making visible the inequalities and discriminatory practices faced by women in the construction industry.

The thematic map complements this conceptual structure in terms of centrality and level of development. The inclusion of themes such as the construction industry, women, and gender discrimination in the basic themes suggests that the field has reached a degree of theoretical saturation in problem definition. The blue cluster in the center of the MCA map confirms this and represents the core axis of the literature. Furthermore, the basic themes in Fig. 7 perfectly match the blue cluster in Fig. 8. This indicates that these issues are accepted as sectoral realities in the literature. The focus of the literature is no longer on proving the existence of the problem, but on discussing it in a solution-oriented manner. Future research could go beyond problem identification and explore ways to explain the transformation processes within the construction industry. The integration of emerging technologies, digitalization, Industry 4.0, and artificial intelligence, along with the effects of current transformations, could be examined in future studies.

Concepts such as culture, built environment, education, career choices, and participation, which are included in the motor themes of the thematic map, are located in different clusters in the MCA. This shows that, while focusing on the core problem areas of the literature, a multidimensional research structure has emerged that extends into cultural, educational, and structural dimensions. Nevertheless, considering that women work in different geographies and in various positions, studies examining their daily work and construction site experiences, along with organizational and cultural factors, constitute a significant research opportunity in the literature.

The most noteworthy areas for future research are the emerging themes on the thematic map. These concepts demonstrate that the site experiences of women in the construction industry, their management roles, entrepreneurial processes, and the barriers they face in reaching top management levels have been addressed by a limited number of studies.

Themes such as strategies, retention and career progression, which are located in separate clusters on the MCA map, have not been sufficiently integrated with these fields. This points to a significant research opportunity in the literature for multi-

level studies that examine women's career development, management practices, and the glass ceiling together. Most existing studies focus on the barriers and problems women face. In contrast, there are very few studies that examine how women advance in the construction industry, how they demonstrate resilience in the face of challenges, and the organizational and individual factors that enable their success. In this respect, research that focuses on success and presents examples of good practice offers significant potential for advancing the literature.

The fact that career barriers themes are included in both country-focused clusters in the MCA and appear within basic themes on the thematic map indicates that this topic is widely discussed in the literature, but mostly in a way specific to local conditions. This situation points to an important research opportunity for comparative studies examining findings across different countries.

## 5. Constructive Limitations

While this study has some limitations, these limitations also present significant opportunities for future research. Firstly, bibliometric analysis is limited to publications obtained from the WoS database. Analyzing studies indexed across different databases in a bibliometrically comparable manner requires harmonizing data formats and implementing a comprehensive preprocessing. Therefore, some essential studies outside of WoS may have been excluded from the scope of this analysis. Future research that includes comparative analyses across databases such as Scopus and Google Scholar will contribute to a broader perspective on the literature.

Secondly, to maintain comparability, only English-language publications were considered in this study. Therefore, some studies published in different languages and containing significant findings specific to local conditions may have been excluded. This presents an opportunity for future bibliometric analyses that include publications in other languages.

Finally, the search was conducted on September 8, 2025. Studies published after this date were not included in the analysis. Therefore, the findings reflect the literature at a specific time. It is possible to track new trends through future updates and re-analyses.

Overall, these limitations do not invalidate the study's findings. They point to new research opportunities to address the literature with broader data sources and more up-to-date studies.

## Declarations

## Conflict of Interests

## 6. Conclusions

The present research carried out a scientometric analysis of academic studies investigating gender-related barriers encountered by women working in the construction industry. Analysis of 214 publications from the WoS database reveals that this topic is receiving increasing academic attention globally. The increase in publications, particularly since 2020, indicates that SDGs and industry-specific regulations have increased interest in gender equality in the construction industry. The increase and thematic diversity observed in the literature are closely related to the strengthening of the sustainable development approach, the emphasis on actual equality within the CEDAW framework, and the acceleration of global policy discussions on gender equality. The increased focus on gender inequality, work-life balance, and organizational culture during this period can be attributed to changes in working conditions brought about by the COVID-19 pandemic, the widespread adoption of remote and flexible work models, and the acceleration of digitalization. These developments have made the structural barriers and institutional practices that women face in their careers more visible. Therefore, recent academic studies have not focused solely on individual experiences.

Thematic mapping and MCA reveal three key trends in the literature. First, individual-level issues such as gender discrimination, harassment, and sexism are central to the research. Second, factors such as career development, leadership, entrepreneurship, and the glass ceiling are considered structural barriers limiting women's professional advancement in the construction industry. Third, specific factors such as cultural norms, education, organizational culture, and work-life integration are seen as determinants shaping women's participation in the industry.

This study contributes to construction management literature by showing that gender-based barriers in the construction industry are not only social issues but also management-related challenges linked to organisational culture, career systems, and site practices.

Gender equality in the construction industry is multidimensional, influenced and shaped by individual experiences, institutional practices, and social structures. Promoting gender equity within the construction industry will ensure the rights of the women workforce, increase productivity, and help achieve sustainability goals.

Consequently, future research can address the issue at the micro level through studies on women's individual experiences, and at the macro level through studies on policy, culture, and institutional strategies.

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

This research received no external funding.

## Author Contributions

Ş. Ak: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing- Original Draft, Writing-Review and Editing, Visualization.

## Acknowledgments

Not applicable.

## Data Availability Statement

The search query used in data collection is available in the study.

## Ethics Committee Permission

Not applicable.

## Use of Generative AI and AI-assisted Technologies

The author confirms the author did not use any AI tools in the preparation of this study.

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