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INDUSTRY 4.0 TECHNOLOGIES AND LAW IN ENHANCING HUMAN CAPACITY AMONG WOMEN IN THE NIGERIA CONSTRUCTION INDUSTRY: A SYSTEMATIC REVIEW.

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ABSTRACT
Purpose: This study examines the impact of Industry 4.0 and the role of law in enhancing women's involvement in Nigeria's construction sector.
Design/Methodology/Approach: The study adopted a systematic review of relevant literature from Scopus, IEEE Xplore, Science Direct, EBSCO, Emerald Insight, and Proquest Central between 2011 to 2023 on the various issues addressed in the research. A thematic analysis was adopted to discuss the findings from the reviewed articles in line with the study's objective.
Findings: Industry 4.0 technologies enhance women's involvement in the construction industry by automating risky tasks, ensuring safety, and reducing working hours for family responsibilities. Limiting women's participation in construction results in unconstitutional gender-based discrimination and the law has not been fully explored in ensuring gender equality in the construction industry.
Research Limitation/Implications: The study's reliance on a systematic literature review may limit capturing real-time industry dynamics.
Practical Implication: Implementation of industry 4.0 technologies in the construction industry has the potential to create a safer, inclusive work environment by automating hazardous tasks and reducing working hours.
Social Implication: Construction 4.0, if embraced, has the potential to challenge traditional gender norms, fostering a more equitable industry.
Originality/Value: The study offers a novel approach that assesses the collective impact of technology and the law on enhancing women's participation and capacity-building initiatives, thereby contributing to gender equality and empowerment in the industry.
Keywords: *Construction industry. human capacity. industry 4.0. law. women.*

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INTRODUCTION

Globally, the construction industry is perceived as an important sector to economic growth and development alongside the agricultural and rapidly growing Information Technology (I.T) industries (Pheng & Hou, 2019). International Labour Organization (2018) stated that the construction industry employs more than 100 million people, accounting for 6-7% of the labour force globally. According to statistics, the construction industry is the second highest employer of labour in developing economies like Nigeria and Ghan, accounting for over 25% of the workforce in Nigeria, and the second largest GDP contribution of 13.7% (Punch, 2018; Boadu, Wang, & Sunindijo, 2020). The sector is notable for job creation, requiring various skills and diverse proficiency. The construction industry constitutes a significant bedrock to the development of the economy as other industrial sectors depend heavily on the production of the construction industry to perform optimally (Boadu et al., 2020; Alaloul et al., 2021).

The construction sector in Nigeria serves as a critical driver for the nation's economic progress, making substantial contributions to employment and GDP. It comprises many sectors, including infrastructure, commercial, and residential developments (Jimoh et al., 2016). The industry is impacted by population increase, urbanization, and government efforts and frequently faces challenges related to project delays, cost overruns, and a fragmented regulatory framework (Boadu et al., 2020). The Nigerian construction industry's workforce combines skilled and unskilled labour, men and women. The sector's ability to withstand challenges, along with strategic actions, establishes it as a significant contributor to Nigeria's pursuit of economic advancement and modernization (Boadu et al., 2020).

Women's human capacity is crucial in influencing the composition of a dynamic and diverse workforce within the construction industry. Women have historically made substantial contributions across multiple domains in the construction industry, showcasing their aptitude and fortitude which includes addressing labour shortages, and promoting a more sustainable and robust industry (Akinsiku and Ajala, 2018). Women have also exhibited exceptional aptitudes for leadership and organization, guaranteeing successful management and prompt delivery of tasks. Their invaluable inputs in engineering and design enrich the range of viewpoints, thereby nurturing innovation and comprehensive solutions (Norberg & Johansson, 2021). However, studies have shown that women's human capacity is grossly underrepresented in the construction industry (Jwasshaka & Amin, 2020).

Research revealed that most women in the construction workforce are primarily involved in management and clerical activities (Ogbu et al., 2021; Akinsiku & Ajala, 2018). Most women seek jobs with more social conditions, such as academy institutions or in-house public settings (Cerrato & Cifre 2018). Furthermore, the cultural belief that women are created to be mothers and wives has also impacted women's education level (Dicke et al., 2019). Additionally, construction work is associated with travels to several localities, extended working durations, and high-stress levels

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(Wu et al., 2018). Working conditions such as poor job site situations, weather conditions, and short-term work have also discouraged women from seeking employment in the construction industry. Research has shown that the number of women registered on campuses reduces as the level of education increases. Interviews with women revealed that they had to put in extra effort compared to their male colleagues to accomplish the same level of recognition due to the general opinion that male specialists perform better than their female contemporaries (Cerrato & Cifre, 2018).

The construction industry has relied mainly on workforce and workforce skills to achieve maximum results over the last decade. It has been seen that the construction sector's progress and the delivery of quality projects have been largely dependent on the workforce's expertise in the industry. However, digitalizing construction processes, through industry 4.0 technologies is a paradigm shift that will alter the current practices in the construction industry. Adepoju and Aighavboa (2020) stated that the implementation of Construction 4.0 would increase partnership and enable harmonious interactions among the workforce on site, increase ingenuity and invention among workers, diminish exhaustion due to the automation of monotonous jobs, and lessen the time spent on a tedious job and increase workers' efficiency. Rastogi (2017) opined that construction in the fourth industrial revolution effectively reduces delivery time and the project's total cost by up to 50%. Research has revealed that the emergence of construction 4.0 will also help to combat the challenges associated with project alteration, variation and excesses. The emergence of construction 4.0 technologies has resulted in better planning, better operations and site control, reduced energy expended in monitoring and reporting activities, and effective on-site modification (Adepoju & Aighavboa, 2020).

Several researches have been examined to evaluate the underlying causes responsible for the inadequate involvement of women in the construction sector (Adedeji et al., 2019; Adeniji et al., 2022; Ikiao & Wanyonyi, 2019). Similarly, researchers have explored various opportunities and revolutions that will be experienced in the construction industry when construction 4.0 is being integrated (Adepoju et al., 2020; Al-Lami, 2021; Alaloul et al., 2020). However, there has been a lack of study on how Construction 4.0 and the implementation of human rights laws against discrimination would increase women's participation in the construction industry. This research examines the prospects of Construction 4.0 to promote the involvement of women in the construction sector and how the law may be a helpful instrument in boosting women's participation in the era of Construction 4.0.

THEORIES UNDERPINNING THE STUDY

The theory of technological determinism holds that technology is the dynamic force behind societal development and has a considerable impact on human conduct. It demonstrates how technological advancements have a major influence on society, resulting in transformation (Hallström, 2022). This theory infers that introducing Industry 4.0 technologies such as robotics, the Internet of Things (IoT), and artificial intelligence into the construction industry has the

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potential to fundamentally transform labour processes, leading to increased efficiency and productivity. This theory is corroborated by several studies that have analysed how technologies are altering many sectors and creating opportunities to boost human capacities (Torosyan et al., 2023; Ra et al., 2019; Horváth & Szabó, 2019). While the introduction of technologies holds invaluable potentials to revolutionize work, Mormina (2019) pointed out that technological advancements can reinforce power dynamics and inequities in work place unless they are utilized with careful consideration.

Gender equality legislation is critical to improving gender inclusion and empowering women in the workplace. Nigeria has created legislative frameworks, such as the National Gender Policy and the Gender and Equal Opportunities Bill, to eliminate discrimination and promote gender equality (National Gender Policy, 2006). The Violence Against Persons Prohibition Act of 2015 also seeks to protect women and children from discrimination and violence (Violence Against Persons Prohibition, 2015). Hervías- Parejo and Radulović, (2023) affirmed the importance of legislative initiatives in combating gender discrimination and ensuring women's access to work, training, and opportunities for advancement. Nonetheless, evidence reveals that even in the existence of such rules, gender disparities persist. Discrimination against women persists in inheritance, marriage, and work, restricting their economic empowerment and political engagement. Despite having ratified international conventions such as CEDAW (CEDAW, 1979), Nigeria still struggles to successfully implement gender equality legislation. The Gender and Equal Opportunities Bill, which aims to redress these inequities, has experienced resistance in the National Assembly, preventing its effective implementation (Christopherson et al., 2022). Furthermore, customary norms sometimes overrule legislative laws, exacerbating gender inequities (Gostin et al., 2019). (Bermúdez Figueroa et al., 2023; Yetiş & Bakırlıoğlu, 2024) also revealed the prevalence of structural barriers, including cultural biases, limited educational and training options, and strongly embedded gender stereotypes.

Hence, the potential of Industry 4.0 technologies to improve human capabilities and promote gender equality in the Nigerian construction sector can only be achieved through a comprehensive strategy that combines technical innovation with legal and regulatory reforms. It therefore implies that gender equality laws, if adopted correctly in the construction industry, may help mitigate inequalities or power dynamics that may arise as a result of the use of industry 4.0 technologies in the industry.

Causes of Low Women Representation in the Construction Industry

Over the years, research has been steered to assess the involvement of women in the construction industry in both industrialized countries and developing nations. Globally, statistics have shown that female participation is low despite the benefits of the construction sector in economic development. Jwasshaka and Amin (2020) posit that women are reasonably represented in industrialized countries such as Germany, Portugal, Austria, France, and the Netherlands compared to developing countries. Research conducted by Anuar et al. (2017) on the challenges

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and hindrances of women's involvement in the construction industry within the Klang Valley area of Malaysia revealed that low women involvement is attributed to factors such as family obligations, work environment, private life demands, sexual harassment, stereotyped working times, gender bias, selection criteria and male-dominated courses, industry's image, women's physical abilities amongst others. Other factors that deter women's representation in the construction industry include lack of support and cooperation from employers and family members, Women's reception of the attitude, behaviour and perceptions of the male gender, male resentment against women, communal belief and perception of the construction industry as well as restricted advancement opportunities (Anuar et al. (2017)

Additionally, according to Afolabi et al. (2019), the construction sector and other fields have not completely tapped into the distinctiveness and power of the female population. According to the study's literature survey, the barriers that impede women's participation in the construction industry encompass the perceived image and knowledge of the industry, the ethos and working environment, family responsibilities, the industry's male-dominated nature, training paths and recruitment policies, gender role socialisation, gender discrimination, and sexual harassment. Adeyemi et al. (2016) also investigated the acceptability of construction activities for women and the restrictions that limit female success in the sector. According to the study, female representation in the construction business amounts to around 16.30% of the workforce, while male participation accounted for 83.70%. The characteristics that contribute to the preference for males in the construction business, such as technical ability and experience, potential for high efficiency, academic credentials, and physical strength, rarely benefit women as compared to men during entry into the profession. This serves as a barrier for women participating in the field.

Jimoh et al. (2016) conducted a survey to assess women's participation in the Nigerian construction industry; the study revealed poor female representation and involvement in the Nigerian construction industry. Challenges that were identified include the lack of self-confidence to contend with male colleagues in the construction industry, sexual harassment, family obligations and recruitment policies and procedures in the industry, negative perceptions of women's capabilities and lack of mentoring as setbacks that have mired the contribution of women in the industry. Likewise, Akinsiku and Ajala (2018) investigated the obstacles to female participation in the Nigerian construction industry. The results show that male dominance of the industry and family obligations were the significant constraints for women involved. Other factors identified were the masculine nature of the job, lengthy working periods, and socio-cultural opinions and orientations about the female gender not being as strong as their male contemporaries.

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RESEARCH METHODOLOGY

This systematic review was implemented using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The search strategy was developed following a preliminary assessment of Construction 4.0 and the Nigerian construction industry. The full text and abstracts of research publications were located using online databases, including Scopus, IEEE Xplore, Science Direct, EBSCO, Emerald Insight, and Proquest Central. Key publications and reference lists of included articles were hand-searched to identify additional relevant articles and potentially relevant recognized sources were assessed for inclusion. Furthermore, Google Scholar was hand-searched for studies published between 2011 and July 2023. The search was conducted using two broad areas: Opportunities of Construction 4.0 for Women's Participation in the Nigerian Construction Industry and Gender-responsive laws. A Search term was developed for each area and ran separately using the Boolean phrases "CONSTRUCTION 4.0" AND "WOMEN'S PARTICIPATION" AND "NIGERIAN CONSTRUCTION INDUSTRY" and "GENDER-RESPONSIVE LAWS" AND "CONSTRUCTION 4.0" AND "WOMEN'S PARTICIPATION" AND "NIGERIAN CONSTRUCTION INDUSTRY". The initial search produced a total of 147 articles. Duplicate and irrelevant articles by titles were removed to have an initial search outcome of 32 articles The studies that were included in the review satisfied the following requirements: (1) focused on Construction 4.0 and women participation in the Nigerian construction industry (2) Peer-reviewed journal articles, conference papers, and reputable scientific sources (3) published between 2011 and 2023 (4) published in English language (5) highlighted the legal frameworks, policies, regulations, or initiatives about gender equality and women's rights in construction (6) focused explicitly on the Nigerian construction industry. The abstract and full text of 32 articles were reviewed for inclusion, among which 23 were excluded for failure to meet inclusion criteria. Finally, nine (9) articles were identified for this study.

The screening procedure consisted of two phases. Three researchers independently evaluated the study titles and abstracts in the initial phase. One hundred forty-seven studies were screened in total at this stage. If studies were determined to be pertinent to the objectives of the literature review, they moved on to the following screening phase. In addition, studies that lacked abstracts or whose relevance to the review could not be determined based on the abstract and/or title were advanced to the next stage for full-text screening. The same academics who independently evaluated the full texts of 40 studies conducted the second filtering phase. During the screening procedure, at least two researchers resolved any conflicts in article selection. The third researcher was enlisted when consensus could not be reached. 9 articles were passed on to the data extraction stage. Two researchers reviewed all nine (9) articles to perform data extraction. The following information was extracted: author(s), year of publications, and research findings. To ensure the rigour and accuracy of the extracted data, two researchers reviewed and made any necessary corrections to the

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extracted data. A significant constraint of this study is the limited availability of original research that explicitly examines the convergence of industry 4.0 technologies and regulatory frameworks within the Nigerian construction sector, particularly regarding the involvement of women. Due to the highly specialized nature of the subject matter, the available pool of relevant research was limited, potentially impacting the comprehensiveness of the systematic review.

Additionally, despite the researchers' objective of reaching a consensus and their inclusion of a third researcher to address disagreements, the first stage of the investigation depended on individual assessments of paper titles and abstracts. The presence of variability in interpretation or subjective judgement among researchers at this phase may result in the rejection of studies that might be relevant or the inclusion of irrelevant studies. This may lead to selection bias impacting the systematic review's overall comprehensiveness.

The qualitative data from the reviewed articles was read and thematically analyzed by the authors. The analysis identified recurring themes related to Industry 4.0, women's participation in the construction industry and gender laws. The identified themes were categorized and discussed according to the study's objectives.

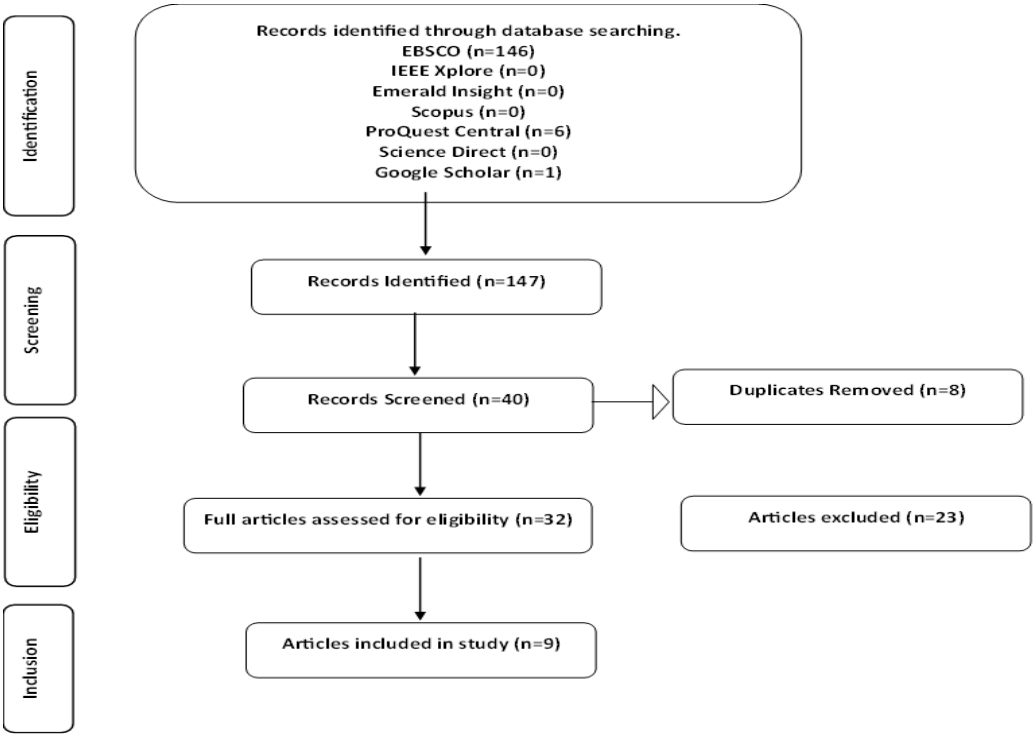

Figure 1: Visual presentation of the article selection process

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FINDINGS AND DISCUSSION

Opportunities of Industry 4.0 Technologies Towards Increasing Women's Participation in the Construction Industry.

The use of the new resources, tools, and technologies of Industry 4.0 can lead to improvements in working conditions, employee productivity, and environmental compatibility (WEF, 2016). In the construction sector, workers are involved in various tasks and interactions with other people and often face psychological, social, and environmental challenges that might restrict their job performance and affect its quality (Adepoju & Aigbavboa, 2020). Most tasks performed on construction sites, such as sanitation, transportation of supplies, site preparation, filling, concrete blending, and excavation of trenches and scaffolds, are seen as displeasing and hazardous by the labourers. Nevertheless, the use of innovative technologies like robots, smart manufacturing, and BIM can increase employee satisfaction among workers. This may be accomplished by collaborating with robots, who will serve as co-workers, to handle the most challenging aspects of construction work (FIEC, 2019, Adepoju & Aigbavboa, 2020).

Therefore, the utilization of technology in complex and hazardous tasks will enable women to actively engage in construction, thereby enhancing women's involvement. Implementing Industry 4.0 technology also brings the advantage of automating construction activity, which in turn reduces the amount of time workers need to spend on the project site. According to Adepoju and Aigbavboa (2020), automating physically demanding tasks on construction sites would reduce workers' tiredness, leading to improved productivity. This advantage also enhances the appeal of the construction industry to women, enabling them to balance construction employment with other responsibilities, such as fulfilling their commitments at home.

Slowey et al. (2019) state that introducing Industry 4.0 technology has enabled the automation of repetitive and monotonous tasks in the construction sector. This automation has resulted in a more efficient and productive workforce, allowing professionals in the field to enhance their abilities and inventiveness. Construction 4.0 encompasses the mastery of various technologies, including unmanned aerial systems, cloud-based project management, Building Information Modelling (BIM), artificial intelligence, Common Data Environment (CDE), laser scanner, blockchain, Augmented Reality/Virtual Reality (AR/VR), cyber security, automation, sensors, big data and analytics, Internet of Things, and Robotics (Forcael et al., 2020). According to Choo (2019), women exhibit more assertiveness in problem-solving and can rapidly adapt to emerging technologies, especially those associated with Industry 4.0. This flexibility will lead to more female involvement in Construction 4.0. Cerika and Maksumic (2017) support the view that new technologies will create opportunities for obtaining new skills, leading to specialization, increased creativity, competitiveness, and other benefits. Additionally, this study uncovered that the

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emergence of Construction 4.0 will result in time savings and enhanced site safety, less financial and reputational risks, improved sustainability, and increased productivity (Cymraeg 2021).

Research has also shown that the introduction of digital skills may be a means of empowering women (Mani & Mhendraprabu, 2014). As a result, this will provide new job opportunities, such as industrial data scientists and robot coordinators (Alalol et al., 2018). In addition, the emergence of Construction 4.0 will provide several methods to address health and safety issues for construction workers by utilizing new technology. This will result in a decrease in accidents and fatalities, as well as enhance production within the sector. Raphelson (2019) said that the primary reason for automating industrial processes is to ensure the safety of workers. By replacing human workers with automated systems, the risk of workplace hazards is eliminated, therefore shielding the workers from potential dangers in their work environment.

In addition, using drones and Building Information Modelling (BIM) as emerging technologies minimizes the likelihood of accidents by conducting external inspections and assessments to identify potential hazards. This enables construction teams to obtain accurate information necessary for ensuring health and safety at construction sites (Alomari et al., 2017; Adepoju & Aigbavboa, 2020). Minimizing hazards in the construction business will lead to a boost in worker productivity and efficiency. The use of new technology in the construction sector will lead to a rise in women's involvement and participation since it guarantees their health and safety. Furthermore, using digital technology and tools will enhance the efficiency of workers' tasks by providing constant access to up-to-date project information (Adepoju & Aigbavboa, 2020).

Role of Law in Enhancing Women's Participation in the Era of Construction 4.0

The fundamental principles of fairness and justice serve as a foundation for achieving gender balance in all sectors, ensuring equal opportunities for both males and females. Various equality policies implemented throughout the years have called for equal participation of both males and females in several fields (Afolabi et al., 2019). Nevertheless, Nigerian society may be accurately characterized as a patriarchal society due to the presence of several variables, including culture, religion, social practices, and discriminatory legislation, which continue to intensify the marginalization of women (Okongwu 2021). This is seen in several national laws and policies that promote discrimination against women (Ekhator 2015). For instance, a variety of laws facilitate domestic violence against wives in Nigeria. According to section 55 of the Penal Code, men are legally allowed to discipline their spouses. According to Subsection 10, any action carried out by a husband to correct his wife is not considered an infraction unless it causes severe injury to the person. According to Ashiru (2010), the Penal Code permits domestic violence against women as long as it does not result in serious injuries or injury. These articles of the Penal Code remain in force regardless of section 34(1) of the Nigerian Constitution, which grants "individuals the right to be treated with dignity."

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In addition, several customary laws continue to impose cruel practices on women who become widows, such as consuming the water used to cleanse the deceased body or cutting off their hair. According to Ifemeje and Umejiaku (2014), the brother of the dead receives a portion of the deceased's estate. Female genital mutilation (FGM) is a prevalent cultural practice that discriminates against women in several Nigerian cultures. This practice continues based on the assumption that it maintains female virginity and decreases promiscuity in women (Ifemeje & Umejiaku, 2014). In addition, Nigerian society and religious traditions perceive women as the more vulnerable gender whose role is mostly in the kitchen. Consequently, discriminating behaviours, particularly by males, are encouraged (Ekhator 2015).

The emergence of democracy and the efforts of some non-governmental organizations and international agencies have led to improvements in the status of women. This has been achieved via the amendment or abolition of certain laws and regulations (Ekhator 2015). Various legal instruments, including the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), the African Charter on Human and Peoples Rights, and the Protocol on Women of Women in Africa, have been implemented to address gender-based discrimination (Ekhator 2015). The African Charter has been incorporated into Nigerian legislation, and it advocates for the rights of women in several of its provisions. Article 3 of the Charter mandates governments to combat prejudice against women using legal and organized methods (Ekhator, 2015). Research has consistently shown that women are still not well-represented in the construction business, which is commonly perceived as a traditionally male-dominated field (Afolabi et al., 2019). In addition, the Nigerian traditional structure portrays women as the less physically strong gender (Ekhator 2015). The construction sector has traditionally been depicted as a field that demands physical strength, resilience to outside circumstances, adverse weather, and a culture that may exclude women (Afolab1 et al., 2019).

One of the primary aims of the Nigerian Constitution, as seen in its preamble, says: "…AND TO PROVIDE for a Constitution to promote the good government and welfare of all persons in our country, on the principles of freedom, equality, and justice, and to consolidate the unity of our people" (Nigerian Constitution 1999 as amended in 2021). In light of the preceding, it is clear that the Nigerian Constitution, which is the supreme law of the land, frowns at any form of discrimination. In particular, the Nigerian Constitution is clear on gender discrimination. The Nigerian Constitution of 1999, in sections 17(1) and 2(a), recognizes the equality of rights, obligations and opportunities between the male and female gender before the law, and articles 11 states that women shall have equal rights as men concerning employment opportunities, choice of professions, promotions and remuneration. Also, Section 17(3)(e) of the Nigerian Constitution enjoins the State to tailor its policies towards ensuring equal pay for equal work without discrimination on account of sex or any other ground.

Furthermore, sections 15(1) and (2) states that "The motto of the Federal Republic of Nigeria shall be Unity and Faith, Peace, and Progress. Accordingly, national integration shall be actively

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encouraged, while discrimination based on place of origin, sex, religion, status, ethnic or linguistic association or ties shall be prohibited." Section 42 (1) (a), (b), (2), and (3) also prohibits discrimination based on sex. Therefore, employers' attempts to exclude women from employment in any sector can be termed as discrimination as such unconstitutional.

Therefore, excluding or limiting women's participation in the construction industry is tantamount to discrimination, as they should enjoy the same privileges as their male counterparts. With the coming of construction 4.0, the excuses of women not performing specific duties in the construction industry are no longer tenable as most operations have been automated. However, no specific legal provision regarding discriminatory behaviour while hiring an employee exists. However, according to the Constitution in section 17(3), the State is responsible for ensuring equal opportunity for all in securing adequate means of livelihood and opportunity for citizens without discrimination (Babalogbon, 2019). Therefore, constitutional regulations need to enforce these laws that provide for women's participation by making provisions that companies must engage more women and other conditions that encourage women's participation to strengthen equality in the workplace. Furthermore, erring companies should be penalized or fined to serve as a deterrent to others. NGOs should also use the justice mechanism in the African Charter to mend the quandary of women in the construction industry, as was used in the oil and gas sector (Ekhator, 2014).

CONCLUSION

Construction in the Industry 4.0 era undoubtedly introduces innovative dynamics to the entire construction industry. It minimizes the risks often associated with the construction industry. These risks have been part of why women's participation in the sector has been low. Furthermore, women are not usually employed in the industry as they are considered weak; the construction work is considered masculine, coupled with the long working hours involved and socio-cultural opinions and perceptions about women not being as strong as men. Therefore, industry 4.0 technologies will aid better women participation because they reduce construction work's physical nature as most construction processes are automated, leading to more effectiveness. When construction risks and physical labour are minimized, the industry is certain of women's improved participation, efficiency, effectiveness, and productivity.

In light of the preceding, it is recommended that a more severe approach is taken to ensure the speedy implementation of Construction 4.0 in Nigeria, as it will enhance female involvement in the Nigerian construction industry. This would also help drive economic growth, considering the construction industry's antecedent impact on the economies of developed countries. Several surveys revealed that there is undoubtedly poor representation and participation of women in the Nigerian construction industry. Other challenges that were identified as being responsible for these, aside from the physical nature of the work, are the absence of confidence to strive with male colleagues in the construction industry, sexual harassment, family obligations and recruitment

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policies and procedures in the industry, negative perceptions of women capabilities and lack of mentoring as setbacks that have hindered the involvement of women in the industry.

As stated earlier, construction 4.0 will solve some challenges for low female participation in the construction industry. However, without a doubt, construction 4.0 is not the silver bullet to solving all the challenges; it is a valuable tool to solve some of them. The other challenges identified can be addressed by societal re-orientation and the law. That is by strategically incentivizing and enforcing existing laws. As earlier stated, the Nigerian Constitution, the supreme law of the land, is clear on gender fairness and issues relating to discrimination against people centred on gender.

Implications for Policy, Practice and Future Research

Implications for Policy

The research emphasizes the significance of enforcing constitutional provisions that guarantee equal opportunities for all citizens without discrimination. Policymakers must implement measures and policies that ensure the enforcement of equality laws within the construction sector. This may need the establishment of tailored legislation or recommendations for enterprises to adhere to. There is also a need for policy measures that penalize or sanction companies found culpable of discriminatory practices in employing or promoting employees to strengthen workplace equality. This can serve as a deterrent to other businesses and motivate them to prioritize gender equality.

According to the research, Nigeria should prioritize the ratification of international conventions like the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW). This would demonstrate a national commitment to gender equality and women's empowerment.

Implications for Practice

The implementation of Construction 4.0 technologies has the potential to be an essential catalyst for increasing women's participation in the construction industry. Hence, construction companies should embrace and implement these technologies to reduce physical labour and create a more inclusive and productive work environment. Additionally, construction firms should actively work towards promoting gender diversity by employing more women in a variety of positions within the industry. They should also develop mentoring programmes to assist women in their professions and boost their confidence in male-dominated environments.

Suggestions for Future Research

Future research can evaluate the efficacy of policies and regulations to advance gender equality in the construction industry. This may involve assessing the effect of sanctions, incentives, and international conventions on women's participation. Researchers can also investigate the long-term effects of adopting Construction 4.0 technologies on women's industry participation and

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advancement and whether these technologies are sustainable and can result in long-term enhancements to gender diversity.

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