

Naganarasimhulu, T. and Tawalare, A.G., 2024. Addressing the skilled professional shortage in Indian sustainable construction: A focus on awareness, education, training, and policy interventions. In: Sandanayake, Y.G., Waidyasekara, K.G.A.S., Ranadewa, K.A.T.O. and Chandanie, H. (eds). *Proceedings of the 12<sup>th</sup> World Construction Symposium*, 9-10 August 2024, Sri Lanka. pp. 79-91. DOI: <https://doi.org/10.31705/WCS.2024.7>. Available from: <https://ciobwcs.com/papers/>

# ADDRESSING THE SKILLED PROFESSIONAL SHORTAGE IN INDIAN SUSTAINABLE CONSTRUCTION: A FOCUS ON AWARENESS, EDUCATION, TRAINING, AND POLICY INTERVENTIONS

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## ABSTRACT

*The sustainable construction industry is experiencing rapid growth, propelled by the urgent global need to reduce environmental impact and enhance resilience in the built environment. Nevertheless, this expansion is met with a significant deficit of skilled professionals equipped with the necessary knowledge and expertise in sustainable construction practices. This research explores the multifaceted approach required to rectify this shortage, with a primary focus on enhancing awareness and education, addressing training needs, and implementing effective policy interventions. This study begins with the examination of existing literature related to sustainable construction education, training, and current strategies to identify gaps and challenges. The research methodology entails a literature review to identify factors causing skilled professional shortages in construction. Semi-structured interviews with construction professionals follow this to confirm and explore underlying reasons. Transcripts are then analysed using content analysis to extract main themes and sub-themes. Gaining insight into the root causes of skilled shortages and the challenges within sustainable construction guides the development of targeted strategies aimed at attracting more professionals to the field. Proposed strategies for addressing shortages are validated with construction professionals, and conclusions are drawn. This approach not only helps alleviate professional shortages but also fosters sustainable growth within the sector. The findings of the study offer valuable insights for stakeholders, educational institutions, and policymakers, enabling them to enhance their approaches to sustainability in the construction industry.*

**Keywords:** Construction Industry; Shortage; Skilled Professional; Sustainable Built Environment; Sustainable Construction

## 1. INTRODUCTION

Sustainable development ensures meeting present needs without jeopardising future generations' ability to meet their own, based on the principle that society should

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responsibly use available resources in line with future needs (Mohd-Rahim et al., 2016). The Indian construction industry is a key economic sector contributing significantly to social and economic development (Knight Frank & RICS, 2023). However, the shortage of skilled professionals is a factor impacting project success within the industry (Alshahrani et al., 2023). Skilled construction professionals are essential for designing, building, and maintaining infrastructure, utilising their expertise to incorporate technological advancements, meet project needs, and support the rehabilitation of existing structures (Fathima & Umarani, 2023). Despite people's inclination towards jobs in glamorous industries, the construction industry in many regions still suffers from a negative reputation due to concerns including quality issues, work-related accidents leading to fatalities, perceived lack of professionalism among workers, low productivity levels, and detrimental environmental impacts (Ling et al., 2016).

In 2018, the National Skill Development Corporation (NSDC) projected significant workforce growth, with an expected increase from 45 million in 2013 to 75 million by 2022. The sector was anticipated to generate a demand for 31 million jobs over nine years, divided into 13.98 million jobs required from 2013 to 2017 and 17.15 million jobs needed from 2017 to 2022 (KPMG Advisory Services Pvt. Ltd., 2013). Despite these projections, the real estate and construction sector in India saw a 25% decline in employment from 2017 to 2021, as reported by Statista (2023). However, a critical shortage of skilled professionals poses a formidable threat to sustained expansion.

The scarcity of project managers significantly impacts sustainable construction, leading to cost escalation, delays, diminished quality, increased accidents, and heightened rework (Oke et al., 2018). The shortage of skilled labour significantly impacts construction projects, leading to cost overruns and schedule delays due to lower productivity within the allotted time (Kim et al., 2020). Further to Elbashbishy and El-Adaway (2024), given that labour costs typically constitute 30% to 50% of total project expenses, effective management of labour issues and productivity improvement are critical for ensuring the financial success of projects. These effects directly influence the economic, social, and environmental aspects of sustainable development.

The prior research focused on labour issues such as shortages and employment stability; it mainly documented factors and expected impacts on construction projects. Most of the studies analyse skilled labour flow in construction, aiming to understand shortage complexities and clarify their causes and effects on projects (Alshahrani et al., 2023; Elbashbishy & El-Adaway, 2024; Kim et al., 2020; Mohd-Rahim et al., 2016; Oke et al., 2018). Despite the growing importance of sustainable construction for environmental and economic challenges, India faces a significant shortage of skilled professionals in this sector (Alshahrani et al., 2023; Mohd-Rahim et al., 2016; Oke et al., 2018). Existing literature primarily addresses the general shortage in construction, with limited focus on sustainable construction's specific needs and challenges. Moreover, comprehensive strategies integrating awareness, education, training, and policy interventions are lacking. This research aims to fill this gap by analysing the factors influencing the skilled professional shortage in sustainable construction and proposing targeted strategies to improve professional skills and availability in this critical field. The objective of this research is to investigate and identify the factors contributing to the shortage of skilled professionals in the Indian sustainable construction sector. It aims to analyse these factors comprehensively, assess their impact on the industry, and propose targeted strategies to enhance awareness, education, training, and policy interventions. The study seeks to

provide insights and recommendations that can effectively address the skilled professional shortage, thereby promoting sustainable practices and development in the construction industry in India.

## **2. FACTORS RESPONSIBLE FOR SKILL PROFESSIONAL SHORTAGE IN SUSTAINABLE CONSTRUCTION**

### **2.1 EDUCATIONAL GAPS**

The shortage of educational programs specifically tailored to sustainable construction practices, coupled with the predominant focus of construction programs on traditional methods, leaves a significant gap in training for new techniques (Welfare et al., 2021). To maintain and sustain the construction workers, it was essential to offer prompt evaluations, feedback, and professional training (Karakhan et al., 2023).

### **2.2 ECONOMIC FACTORS**

Adequate pay is a primary reason for entering the industry (Welfare et al., 2021). A larger investment in labour wages will increase the supply of skilled workers, resulting in higher productivity, which will have a positive impact on the supply of skilled workers by either lowering the attrition rate or attracting more people into the construction industry (Aiyetan & Dillip, 2018). Because the current income level is insufficient to justify the physically demanding work required by the construction industry, the majority of young workers do not prioritise this industry as a high priority in their career choice. Therefore, the industry will not be able to draw in young workers until workers' earnings and benefits can be enhanced to a suitably alluring level (Ho, 2016). Moreover, Zhou and Lowe (2003) notes that there is a lack of financial incentives, such as subsidies or tax breaks, to encourage the adoption of sustainable practices, making it economically unattractive for professionals to specialise in this field. Industry culture and workplace dynamics

Undesirable working conditions are associated with working outdoors, such as extreme weather conditions, heat, and cold (Welfare et al., 2021). There may be a decrease in labour attrition due to job dissatisfaction if the working environment is improved through a policy of health and safety and investment in improving working conditions, supported by government policy, which will subsequently enable the reduction of shortages of skilled laborers in the industry (Aiyetan & Dillip, 2018). High physical demands and harsh working conditions in construction sites are key barriers to joining the industry (Sing et al., 2017). It is difficult to draw new participants to the sector due to the perplexing challenges of uncomfortable, unsafe, and dirty working conditions (Ho, 2016). The degree to which employees of a firm or organisation believe they are treated equally and evaluated fairly without experiencing any form of prejudice (Karakhan et al., 2023). Equity is considered to be the most critical component for achieving a high degree of workforce sustainability by frontline workers and supervisors (Karakhan et al., 2023). The pressures of labour and skill shortages would be relieved if new immigrants, women, and ethnic minorities had access to the right training and employment possibilities (Ho, 2016).

Because one significant accident can result in a sharp decline in the number of new hires in the business, the problem of hazards needs to be treated seriously (Ho, 2016). Employers are urged to have written, open policies in place that support professional

development, leadership, and communication training and establish clear guidelines for promotions to all levels (Karakhan et al., 2023).

### **2.3 PROFESSIONAL DEVELOPMENT AND NETWORKS**

Limited professional networks and associations focused on sustainable construction restrict opportunities for knowledge sharing and professional growth. Chan et al. (2018) suggest that the absence of robust professional communities dedicated to sustainability in construction prevents the dissemination of best practices and collaboration among professionals. Female role models do seem to have a practical substantial factor that is more strongly influencing female students' decisions to enrol in the CM degree program (Bigelow et al., 2018).

### **2.4 TECHNOLOGICAL BARRIERS**

Technological barriers also contribute to the shortage of skilled professionals in sustainable construction. Limited access to the latest sustainable construction technologies and materials presents a significant hurdle (Giesekam et al., 2014). Moreover, insufficient investment in research and development (R&D) within this sector hampers innovation and the creation of new sustainable practices and materials (Matar et al., 2008).

### **2.5 AWARENESS AND DEMAND**

Low awareness and demand for sustainable construction practices among stakeholders also significantly contribute to the skills shortage. Many developers and clients are unaware of the long-term benefits of sustainable construction, leading to a preference for conventional methods, which reduces market demand for sustainable projects and diminishes the incentive for professionals to specialise in this field (Zuo & Zhao, 2014).

The shortage of skilled professionals in sustainable construction in India is a multifaceted issue rooted in educational gaps, low awareness and demand, economic factors, regulatory inconsistencies, professional development barriers, technological constraints, industry culture, and workplace dynamics. Addressing these challenges requires comprehensive strategies that encompass educational reforms, increased awareness, supportive policies, economic incentives, and a shift in industry practices toward sustainability.

## **3. RESEARCH METHODOLOGY**

Our research employs a qualitative approach to explore professionals' perspectives and experiences in the sustainable construction sector, suited for understanding the complex nature of skilled professional shortages. The research methodology comprises a literature review to identify factors contributing to skilled professional shortages in construction, followed by semi-structured interviews with 17 construction professionals, including 3 HR personnel, 5 project managers, and 9 project engineers. The professionals interviewed in our study were selected from the Maharashtra region within India, and their insights may not necessarily generalise to the entire country's construction industry. The specific region was chosen because of the combination of supportive policies, economic development, corporate responsibility, awareness, and availability of resources. These interviews aim to confirm and identify factors responsible for skilled professional shortages and explore underlying reasons not covered in the literature. Purposive

sampling was employed to capture a diverse range of professionals in sustainable construction. Participants were selected based on their expertise and relevance to the research objectives, thus enriching the breadth of perspectives examined. One-on-one interviews were conducted to gather rich, detailed insights, allowing flexibility to delve deeply into topics and adapt to new information. While focus group interviews were not conducted, participants were encouraged to share and discuss their experiences, capturing a range of perspectives and fostering a deeper understanding of the issues. The interviews underwent transcription and analysis via NVivo10, a qualitative data analysis software, to facilitate content analysis (Gaur & Tawalare, 2022). Factors contributing to skilled professional shortage were initially coded as nodes through open coding, then grouped under constructs based on discussions and discretion of senior respondents. Additional analysis was undertaken to assess respondents' consensus regarding the viability of strategies to address the skilled shortage for the sustainable construction industry. The interviews underwent Micro-Interlocutor Analysis (MIA), a method by which assesses verbal and non-verbal responses in focus groups (Gaur & Tawalare, 2022; Leech & Onwuegbuzie, 2008), representing agreement via a matrix format while tracking respondents' interactions, response nature, familiarity with questions, and nonverbal cues, as detailed by (Gaur & Tawalare, 2022; Patil & Laishram, 2016).

Table 1: Characteristics of respondents

Characteristics	Gender		Experience (Years)			Education	
	Male	Female	5-10	10-20	>20	Graduation	Post-Graduation
Frequency	12	5	9	5	3	13	4
(%)	70.6	29.4	52.9	30	18	76.5	23.5

#### 4. RESULT AND DISCUSSION

The findings from the content analysis of the semi-structured interviews regarding the factors responsible for the skilled workforce shortage in the construction industry provided a wide perspective and valuable insights into the various aspects influencing the shortage (Table 2). The factors contributing to the Skilled Professional Shortage (SPS) are presented in Table 2 following the analysis.

Table 2: Results of content analysis: Factors responsible for skilled professional shortage sustainable construction

Theme	Subtheme	Description	Author	No of occurrences
Economic	Lack of Financial Incentives	There are limited financial incentives, subsidies, or tax breaks for companies and professionals to adopt sustainable construction practices.	(Zhou & Lowe, 2003)	23
	Limited research and development	Insufficient research and development efforts focused on sustainable construction practices and materials.	(Matar et al., 2008)	8

Theme	Subtheme	Description	Author	No of occurrences
Workplace dynamics	Remuneration and Benefits	Unavailability of basic needs on the construction site, e.g., clean water, toilet, etc	(Welfare et al., 2021)	26
	Working condition	Physically challenging Health and safety issues on construction sites	(Welfare et al., 2021), (Ho, 2016)	15
	Lack of Supportive Leadership and Recognition	Effective leadership that promotes and supports sustainable practices is crucial for fostering a culture of sustainability	(Karakhan et al., 2023)	17
Education and Training Gaps	Training & internships	Lack of / improper training for students in college	(Karakhan et al., 2023)	25
	Course Curriculum	Teaching at the college level is not according to what the industry wants	(Welfare et al., 2021)	13
Industry culture	Working hours	working hours are not flexible, long working hours	(Aiyetan & Dillip, 2018)	18
	Work-life balance	Unable to spend time in non-professional life	(Koc et al., 2022)	20
	Perception of Sustainability	Perceiving sustainable construction is prohibitively expensive, deterring investment in training and hiring skilled professionals.	(Macherla, 2023)	20
	Job security	Lack of job security	(Escamilla et al., 2016)	23
	Gender Bias	Female participation is much less as compared to male professionals	(Escamilla et al., 2016)	14
	Resistance to change	A culture that is resistant to adopting new sustainable practices and technologies, preferring traditional methods	(Gehlot & Shrivastava, 2022)	25
Awareness and Adoption	Limited Awareness	Many construction companies and professionals are not fully aware of the benefits and techniques of sustainable construction.	(Zuo & Zhao, 2014)	19
	Limited access to advanced technologies	Limited access to advanced technologies and materials required for sustainable construction.	(Giesekam et al., 2014)	25

Column 5 in the above table displays the frequency of mentions for each specific factor in the interviews. The sub-factors, represented in Column 2, correspond to the child nodes, while the constructs in Column 1 represent the parent nodes established through discussions with respondents and existing literature. Through analysis, the following 15 sub-factors are categorised into 5 main constructs: economic, educational, workplace

dynamics, industry culture, awareness, and adoption. From the content analysis, the most responsible factors for the skilled professional shortage for sustainable construction are remuneration and benefits, training and internships, Resistance to change, and Limited access to advanced technologies.

The respondents identified remuneration and benefits compared to other professional jobs as a significant factor contributing to the shortage of skilled workers. The perception of delayed salary payments also emerged as a concern. Some respondents mentioned that economic downturns, layoffs, and lack of investment further contribute to the shortage.

Respondent 3 stated,

*Firstly, if somebody is going to adopt any skill, he or she thinks about the outcome, that is, pay or scope. If other sectors are giving better salaries compared to civil, then obviously they will choose these sectors. So, give them good packages and opportunities.*

Respondents highlighted the unavailability of basic needs, such as clean water and toilets, at construction sites, which can impact the attractiveness of the industry. The physically challenging nature of the work and health and safety issues on construction sites were mentioned as factors that discourage individuals from pursuing a career in construction and which lead to further skilled professional shortages.

Respondents expressed concerns about the lack of or improper training provided to students in college, indicating a mismatch between the skills taught in institutions and industry requirements related to sustainable construction. Due to insufficient field experience, new entrants are not liable to work directly in the industry; the organisation has to train them initially from the basics.

Respondents felt that the teaching at the college level is not aligned with industry expectations, which affects the development of practical skills required in the construction sector. Respondents 2, 4, and 6 stated that;

*As per their experience, the knowledge gained during graduation and the required knowledge in practical fields are totally different. Students need to struggle after pursuing a degree separately to skill themselves; the 4 years of engineering are not worth it. Private colleges do offer such courses but fail in teaching and developing skills. Also, our education system is all about memorising things rather than the actual execution.*

The inflexibility and long working hours were identified as a challenge affecting work-life balance and overall job satisfaction by Aiyetan and Dillip (2018) as well. Respondents mentioned the inability to take casual leaves and the mental stress associated with heavy workloads.

The construction industry's physically and mentally demanding nature was seen as a hindrance to maintaining a balance between professional and personal life. Respondent 6 stated,

*We cannot take even casual leaves according to our personal needs; authorities issue leaves according to job site needs.*

The perception of the industry as physically demanding, less glamorous, and male-dominated affected the attractiveness of the sector, particularly among the younger

generation. Concerns about job security within the construction industry were also raised. Respondent 8 stated,

*Many new entrants consider industry only as a blue-collar job and physically demanding job less glamorous than other sectors, and they do not want to work in such challenging conditions. The nature of the industry is not like an attractive office job like the IT sector; financial growth is very slow, and the work culture, especially on-site work not suitable for females.*

Respondents also highlighted the low participation of females in the construction industry, both at the professional and educational levels, indicating the presence of gender bias. Female respondents 10 and 15 stated,

*Speaking as a female professional, in our industry, female participation is very less as compared to male professionals. At the education level also. We cannot deny if we look present scenario that our construction sector is male-dominated. So, this is one of the factors responsible.*

Many professionals believe that resistance to change within traditional practices hinders the adoption of innovative, sustainable techniques. Additionally, limited access to advanced technologies restricts the industry's ability to attract and retain skilled professionals capable of implementing sustainable construction practices effectively. Respondents 10, 15 and 17 states that,

*These perceptions underscore the need for policy support, industry collaboration, and educational initiatives to overcome resistance to change and enhance access to advanced technologies in the Indian construction sector, thereby promoting sustainable practices more effectively.*

Categorising these factors into economic, educational, workplace dynamics, and industry culture constructs facilitates the analysis and comprehension of the diverse elements impacting individuals within their employment and industry contexts. This structured classification enables a comprehensive examination of the factors influencing various aspects of the workforce shortage in the Indian construction industry, aiding in the identification of areas for improvement or intervention.

#### 4.1 EFFECTIVE WAYS TO ADDRESS THE SKILLED WORKFORCE SHORTAGE IN SUSTAINABLE CONSTRUCTION

Similarly, the results of the Micro-Interlocutor Analysis (MIA) are outlined in Table 3.

Table 3: Results of micro-interlocutor analysis: Ways to address the workforce shortage

Strategy	Description	Mean
Education, Training, and Awareness		
Occupational Awareness Campaigns	Increasing awareness among students, parents, and career counsellors about the diverse opportunities and potential of careers in the construction industry	++
Cooperative Industry-Academia Engagement	Fostering stronger partnerships between construction companies and educational institutions to align educational programs with industry requirements.	++



Strategy	Description	Mean
Social Networking and Digital Spaces	Use social media, websites, and blogs to display construction industry successes, trends, and daily operations, targeting younger audiences with visual and interactive content.	+–
Sustainability and Innovation	Emphasise the importance of sustainability and technology in making the industry appealing to environmentally conscious and tech-savvy individuals.	+–
Industry-Relevant Training	Providing opportunities for upskilling and continuous professional development to both students and existing professionals in the construction industry	++
Improving the industry's image and perception		
Incentives and Recognition	Offering competitive salaries, benefits, and growth prospects can position the construction industry as an appealing and financially rewarding career choice.	++
Strengthening Employment Stability	Prioritising job security and professional development can entice individuals to explore its stable and promising career opportunities.	++
Enhancing Work-Life Balance	Recognise the importance of work-life balance in the construction industry and implement measures to improve it.	++
Diversity Empowerment Programs	Embrace diversity and inclusion within the construction sector by creating a supportive and inclusive work environment.	+–
Addressing Safety Concerns	Emphasise the industry's dedication to worker safety and the measures taken to maintain a secure working environment.	++

Note: ++ = strongly agree; + = agree; +– = neutral; – = disagree; and –– = strongly disagree

The last column depicts the average effectiveness of strategies utilised to address skilled professional shortages, organised into constructs derived from common themes identified through discussions with respondents and existing literature. Analysis indicated that respondents generally agreed (+/++) with most strategies, yet they maintained a neutral stance (+–) on three specific strategies: S3, S4, and S9.

#### 4.1.1 Education, Training, and Awareness

Increasing awareness among graduates about the construction industry and its potential career opportunities was suggested by respondents to change perceptions and attract more individuals to the field in order to tackle the skilled professional shortage problem.

*Many young people are not aware of the opportunities available in the construction trades. One way to address this is to increase awareness and interest in the trades by providing information and resources to schools, community centres, and youth organisations.*

Design specialised educational programs and training courses tailored to sustainable construction practices, encompassing areas such as green building materials, energy-efficient design, renewable energy systems, and sustainable construction techniques.

*Collaborating with academic institutions, industry associations, and government agencies to develop and promote educational programs can significantly impact our industry and pave the way for a more sustainable built environment.*

Implementing internship programs throughout the academic years to bridge the gap between industry expectations and college course curricula by establishing collaborations

between industry and educational institutions. Respondents emphasised the need for a revised course curriculum that focuses on practical learning and industry requirements.

*Reforms should be made in the syllabus of engineering colleges, especially private low-grade colleges. In such a college, teachers should be well-trained and experienced enough to deliver the required knowledge and skills to students, which is a demand of the industry. Regular site visits and exposure to unique structures were suggested to develop interest and provide real-world experiences to students.*

#### **4.1.2 Improving the Industry's Image and Perception**

Many respondents expressed the need to improve salaries in the construction industry to attract and retain skilled professionals. Higher salaries were seen to motivate individuals to choose careers in construction.

*Providing incentives, perks, promotions, and flexible working hours were mentioned as ways to enhance employee welfare and satisfaction, along with ensuring basic facilities at construction sites, including proper safety measures.*

Providing a good work-life balance was mentioned to attract and retain skilled workers in the construction industry. One of the respondents stated,

*Provide proper salary, incentives, perks, increments, safety, and basic needs according to the site and location and give a good work-life balance so we can spend a good time with our family and friends; this will help to sort out the shortage of workforce.*

Ensuring job security and stability can alleviate concerns and improve employee satisfaction. Respondents highlighted the importance of adopting new technologies and increasing automation in the construction industry.

Implementing policies related to recruitment, training, retention, working hours, and salary fixation was suggested to improve the overall working environment and employee satisfaction. One of the respondents stated,

*Policies about working hours should be fixed by authorities, either by the government or by the company. Salary should be given as per work done. There must be certain regulations about salary fixation and increments. Attract and motivate students to enter the industry by giving exposure to the industry through industry and institution collaboration. Motivate them to work in such challenging conditions by knowing the role of civil engineers in society.*

Increasing awareness among graduates about the construction industry and its potential career opportunities was suggested by respondents to change perceptions and attract more individuals to the field in order to tackle the skilled professional shortage problem. One of the respondents stated,

*Many young people are not aware of the opportunities available in the construction trades. One way to address this is to increase awareness and interest in the trades by providing information and resources to schools, community centres, and youth organisations.*

Enhancing female participation in the construction industry through various initiatives, such as providing extra perks, stipends, or compensation and nurturing female students

during their degree programs, was mentioned as an important aspect of addressing the skilled professional workforce shortage.

## 5. CONCLUSIONS

In summary, this research emphasises the urgent need to address the skilled professional shortage in India's sustainable construction sector, highlighting the significance of prioritising awareness, education, training, and policy interventions. Through an in-depth exploration of this multifaceted issue, critical gaps and challenges within the industry have been brought to light. Employing a comprehensive approach that encompasses a thorough review of existing literature. Expert interviews and validation of proposed strategies with industry stakeholders, this study lays the foundation for fostering sustainable growth and development in the sector. The insights derived from this research offer invaluable guidance for policymakers, educational institutions, and industry practitioners, offering a clear pathway to effectively navigate and alleviate the skilled professional shortage while advancing sustainability goals within Indian construction practices. In this research, conclusions are drawn based on qualitative data and analysis methods. Therefore, future studies must be conducted using quantitative data analysis with effective sample sizes across different countries and industries. While the research may focus on awareness, education, training, and policy interventions, there may be insufficient analysis of how factors such as gender, caste, geographic location, and socio-economic status intersect with access to educational opportunities, training programs, and employment prospects in the construction sector.

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