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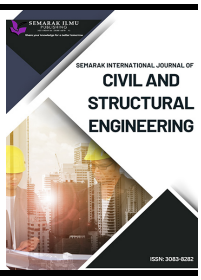

Skills Gaps and Training Needs to Meet Market Demands in the Construction Industry

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ABSTRACT

The construction industry in Malaysia is undergoing transformation driven by increasing demands for sustainability, efficiency, and technological advancement. However, a significant skills gap among workers threatens productivity and project delivery. This gap arises from differences between traditional construction methods and the adoption of new digital technologies by insufficient training opportunities. This study aligns with Sustainable Development Goal 4 (SDG 4), which promotes quality education and lifelong learning. It aims to analyse evolving market demands, identify critical skills gaps, and propose strategies to enhance training programs. Using a mixed-method approach, a questionnaire was distributed to construction professionals across diverse demographics. Data were analysed using descriptive statistics and reliability tests. Results reveal strong agreement on the existence of skills gaps, with respondents indicating that current training is moderately effective but would benefit from more practical, hands-on learning. Digital skills are identified as the highest priority for future workforce development. The findings highlight the need to update training programs to align with international standards and incorporate real-world challenges. Addressing these gaps is vital to improve workforce competency, support industry sustainability, and achieve the objectives of SDG 4.

1. Introduction

The construction industry has faced a few significant challenges due to changes in the regulations, advancements in modern tool and technologies, and the rise of different market demands. A critical issue is the skills gap, where professionals fail to obtain necessary skills and abilities needed to keep up with the demands on the industry, according to Loosemore *et al.,* [1]. This gap was made worse due the integration of modern digital technologies, such as Building Information Modelling (BIM), virtual reality (VR) and artificial intelligence (AI) according to Souza *et al.,* [2] and Zainuddin *et al.,* [3]. There is a gap because of various issues such as the rapid adoption of modern technologies such as

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BIM and the lack of proper training for unskilled workers according to Vasudevan *et al.,* [4] and Ibrahim *et al.,* [5]. Addressing the skills gap would be a critical step for preparing the current and future workforce with the skills required for the emerging demands in the industry. This ensures that project would meet modern standards of efficiency and sustainability according to Weber-Lewerenz *et al.,* [6].

The Malaysian Construction Industry Transformation Programme (CITP) is seeking to improve the industry's sustainability and productivity by producing a qualified workforce capable of meeting global standards, stated by Hassan *et al.,* [7]. Despite the ongoing efforts on sustainability, skills gaps still exist in technologies like BIM, which improves the sustainability of projects. The adoption of Industrialized Building Systems (IBS) would remain low due to the limited investment made and this would hinder training programs according to Saipudin *et al.,* [8]. The construction industry in Malaysia has thrived since the "Vision 2020" initiative that has been boosting the Gross Domestic Product (GDP) by providing new jobs and projects. However, the constant fluctuations of new demands would require workers to adopt new skills and abilities, particularly in response to comparing local practices with international ones according to Pal *et al.,* [10].

As technology advances, the demand for skilled workers have increased exponentially and have driven innovations like Construction 4.0, which integrates digital tools according to Vasudevan *et al., [*4] and Klečina [9]. According to Loosemore *et al.,* [1], the skills gap between older workers and younger workers leads to workplace conflicts where older workers have traditional expertise, and more familiar with modern technologies, as stated by Yee *et al.,* [11]. The number of unskilled workers is greater than the number of skilled workers, resulting in delays in projects and quality issues. This shortage combined with poor human resource management would contribute to a high turnover rate stated by Sulaiman *et al.,* [12]. Therefore, employers may lay off workers lacking necessary skills, which makes the lack of skilled workers a bigger problem according to Kuo *et al.,* [13]

According to Karimov *et al.,* [14], the industry has moved on from traditional methods to modern technologies. According to Weber-Lewerenz *et al.*,[6], the industrial revolutions from the past gave rise to models such as Construction 4.0. Yaung [15] explains how modern methods uses technology to improve labour and material usage. According to Pal *et al.,* [10], globalization would align the practices of locals with international standards, enabling the sharing of information. Malaysia's GDP benefits from necessary measures post-COVID 19 pandemic, providing a growth in the industry, according to Ahmad *et al.,* [16]. Although technologies such as Internet of Things (IoT) and BIM reduce costs, resource limitation would still be a challenge, stated by Zainuddin *et al.*,[3] and Ibrahim *et al.,* [5].

Sulaiman *et al.,* [12] states that skilled shortages were caused by the lack of training, which forces employers to rely on foreign workers. According to Saipudin *et al.,* [8], the adoption of IBS is low because of the lack of investments towards it. BIM adoption is expected to be used in about 50% of projects in Malaysia by 2025. Smaller companies would struggle with the challenge of digitalization and financial issues according to Zainuddin *et al.,* [3]. Fresh graduates lack industry skills is evident, with 71.9% unemployment rate six months after graduating and this highlights a disconnect between academic training and industry needs, according to Krishnappan [17] and Saleh *et al.*,[18]. Moreover, collaboration between employers and academic institutions through internship is critical, according to Razalli *et al.,* [19]. Aligning training programs with Sustainable Development Goal 4 (SDG 4), it would ensure quality education and lifelong learning for sustainable development in the industry Wong *et al.,* [20].

2. Methodology

2.1 Concept

This study uses a mixed-method approach, which combines the qualitative and quantitative methods to investigate if there is a skills gap in Malaysia's construction industry. The primary data in the research is gathered from professionals in the industry through questionnaires. This would provide more insight into the perspective of each professional on determining if a skills gap exist.

Qualitative methods done to gather and capture professionals' life experiences and it provide a non-numerical finding. On the other hand, quantitative methods revealed the trends and patterns of data. The combination of both qualitative and quantitative ensures a more thorough data collection. It would effectively address the skills gap issue and also allow for the suggestions of training needs.

2.2 Sampling

The combination of probability and nonprobability sampling was used in the study. This would improve the reliability of the responses from professionals in the questionnaire. Stratified random sampling was used to balance the representation across different levels of employment, such as top-level, mid-level and frontline workers. By segregating participants, the method would reduce selection bias and would provide more diverse perspectives. This approach would enable a structured selection process that will capture a wide range of experiences.

In contrast, purposive sampling was used to conduct interviews with industry professionals by focusing on specific individuals. This method involves deliberately selecting participants for interviews with questions. This would provide more detailed information from the relevant professional, which provides a richer qualitative data than questionnaires would. By combining stratified random sampling for surveys and purposive sampling for interviews, the study ensures that the results and findings would be unbiased. This approach would allow for a reliable data collection of professionals in Kuala Lumpur.

2.3 Research Design

The research design for this study was a structured questionnaire using Google Forms to collect data on the skills gap in Malaysia's construction industry. The questionnaire was designed with four sections consisting of; demographic information, skills gap in the industry, training and development, and future needs and recommendations. The questionnaire would ensure that participants understand the context of the questions by stating the purpose of the questionnaire during distribution. The questionnaire was distributed through platforms such as WhatsApp, Messenger and LinkedIn towards working professionals in the construction industry.

The questionnaire contained a variety of question types to collect quantitative and qualitative data. Closed questions was used for participants to respond to Yes/No questions to make it easier for statistical analysis. The open-ended questions allowed participants to express their own personal experiences in their own words. Moreover, checklist questions would have allowed participants to select multiple options based on their preference.

3. Results

3.1 Reliability Test

This study assesses the skills gap in Malaysia's construction industry using data from the questionnaire distributed to professionals. The responses compiled by the questionnaire would be exported and stored in Microsoft Excel and analysed in SPSS software. The Cronbach's Alpha value can be determined to evaluate the reliability of each section of the questionnaire, excluding the demographic profile. The result from SPSS showed that the questionnaire has an acceptable reliability as the Cronbach's Alpha value for Part 2: Skills Gap in the Industry is 0.731, consisting of eight questions. The Cronbach's Alpha value for Part 3: Training and Development is 0.708, consisting of seven questions and 0.720 for Part 4: Future Recommendations, that consists of seven questions. All of the value were within the 0.70-0.79 range, which confirms that the data received was consistent and reliable.

3.2 Demographic Profile

The demographic profile of respondents was gathered to ensure a diverse representation of professionals in Malaysia. The questionnaire collected the email addresses to ensure respondents were genuine and to ensure their privacy. Other demographic information includes age, gender, years of experiences, type of organisation and finally, employment level. This would provide different opinions on the skills gap issue. The diversity would contribute to the research's ability to provide an insight into the skills gap of the workforce.

The age distribution of the respondents showed that 41% were between the ages of 31 and 40 years old. Respondents aged 20 to 30 years old made up 25.3% of the respondents. Respondents who were aged 41 to 50 years old made up 21.7% of the respondents and finally those over 50 years old made up 12% of the total respondents. The gender of respondents consists of 56.6% male and 43.4% female. This shows that the construction industry in Malaysia is male dominated.

In terms of experience levels, 37.3% of respondents have more than ten years of experience, 33.7% of respondents have six to ten years, 19.3% have one to five years and 9.6% have less than a year of experience. Over 70% of respondents had more than six years of experience, indicating an experienced group of respondents. Respondents were from various types of organisations. 28.9% of them were from engineering firms, 18.1% from architectural firms, 16.9% from consultancy firms, 12% from contractors, 8.4 from quantity surveying companies, developers consist of 8.4% of total respondents and finally, valuers and suppliers consist of 3.6% each.

The employment levels showed that 55.4% of respondents are in mid-level management roles, such as project managers and senior engineers. 38.6% of respondents in frontline workforce and 6% in top-level roles, such as Chief Operating Officer (CEO)and Chief Operating Officer (COO). This shows that most respondents are in mid-level management roles, where they are in charge of project executions.

3.3 Skills Gap in the Industry

Skills in the construction industry consists of a lot of different technical, managerial and interpersonal skills. These skills are required by professionals to complete projects with the most efficiency and consistency. This section investigates the skills gap in the construction industry using SPSS to perform descriptive statistical analysis. Three Likert scale statements showed the level of agreement between respondents on the topic of a skills gap as shown in Figure 1. The statement on

the existence of a skills gap had a low standard deviation of 0.477, which shows a strong agreement at 72.3% agreed and 25.3% strongly agreeing. The statement states whether the skills shortages negatively impact project performances had a slightly higher standard deviation of 0.548, which shows very little variation of responses by the respondents at 65.1% agreeing, and 28.9% strongly agreeing to the statement. The struggle to find qualified workers had a standard deviation of 0.646, which indicates wider range of responses at 63.9% agreeing and 26.5% strongly agreeing.

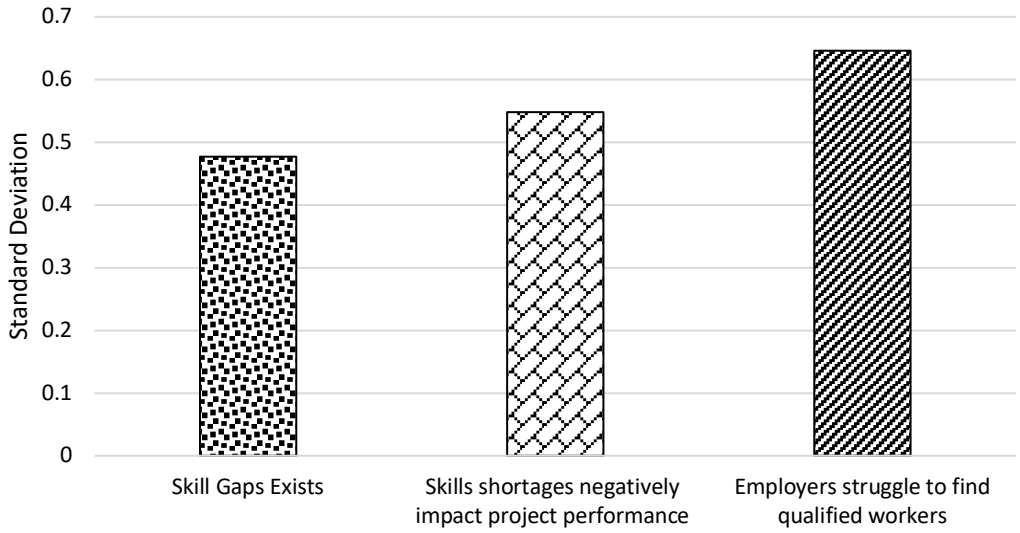

Fig. 1. Level of agreement between respondents

The skilled gap is evident through a multiple-choice question, where respondents had to select what skills that they believed were lacking in the industry. The choices ranged from digital skills, green building, project management, safety and technical skills as shown in Figure 2. Digital skills were the most frequently chosen skill where the standard deviation is 0.397 and was chosen by 80.7% of respondents. Green building and sustainability practices came in next with a standard deviation of 0.462, where 69.6% of respondents chose it. Project management is another skill where the standard deviation was 0.490 and it was chosen by 61.4% of respondents. Safety and regulatory compliance, chosen by 27.7% of respondents while having a standard deviation of 0.450. Finally, technical trade skills with a chosen rate of 20.5% and a standard deviation of 0.406. The lower standard deviation for digital skills shows that there is a higher consistency of agreement compared to project management.

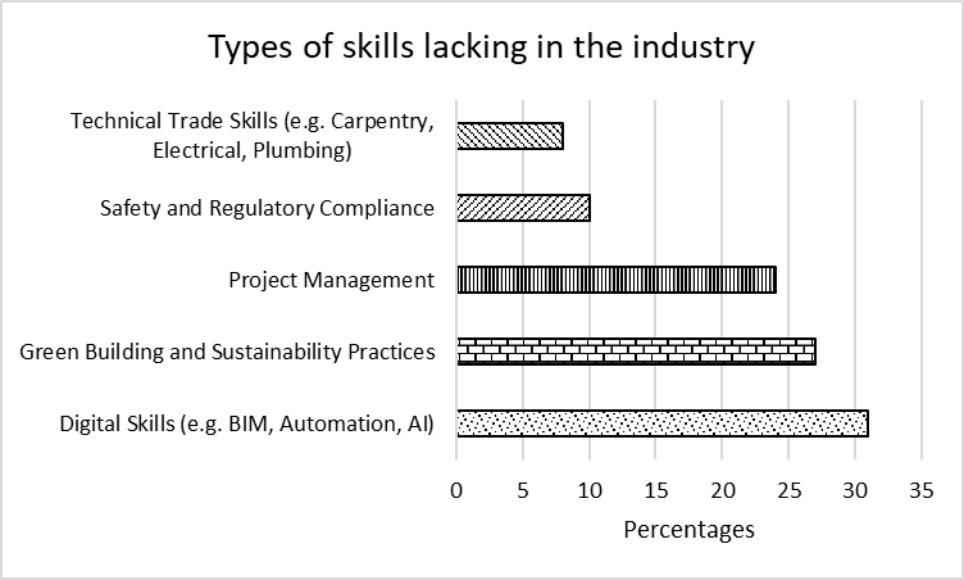

Fig. 2. Skills lacking in the industry

The open-ended questions provided qualitative information about the reasons for the current skill shortages. Most respondents that have filled the open-ended questions, would mention about the disconnection between university education and real-world applications. This shows that theoretical knowledge does not necessarily apply in the practical world. A few respondents have mentioned that the training programs are too expensive to go to, making it hard to gain new skills. There is also a generational barrier where the younger generation are more technologically savvy, while the older generation have more hands-on experience. Moreover, low salaries and the negligence of employers to send employees for training would also contribute to the number of unskilled workers in the industry. The findings from this open-ended question shows the importance of practical and accessible training for the skills gap to close.

3.4 Training and Development

This section examines the effectiveness of training programs in addressing the skills gap within the construction industry. The questionnaire employed a combination of Likert-scale, multiple-choice, closed-ended, rating scale, and open-ended questions. Respondents were first asked to evaluate the effectiveness of current training programs available. The next set of questions focused on whether respondents had attended training in the past five years, the types of training undertaken, and suggestions for improving these programs. By combining both quantitative and qualitative data, this section provides insights into how training programs are currently perceived and what improvements are needed to better meet industry demands. The Likert scale question was to analyse whether current training programs meet the industry demands. 69.9% of total respondents agreed and 16.9% strongly agreed, showing most believed that existing training programs are effective. However, 9.6% were neutral and 3.6% disagreed or strongly disagreed. This shows that some professionals are unsure if the training programs are keeping up with the changing market demand. These findings shows that most professionals believes that training is beneficial in closing the skills gap and a small percentage of respondents believe the skills gap must be closed to keep up with the demands of the industry.

In the multiple-choice question about training types that could potentially close the skills gap, around 86.6% of respondents chose on-the-job training due to its hands-on approach. This shows

that there is a demand for practical learning. On the other hand, workshops and seminars were chosen by 72.3%, while online courses or certifications were chosen by 69.9% of respondents. This shows that there is demand for a flexible training program. In contrast, only 32.5% of respondents chose university or technical educational programs. Another 18.1% of respondents chosen government-sponsored training. This shows that professionals would prefer training that is fitting towards their own working schedules.

In terms of participation, 77.1% of respondents had attended training programs in the last five years, while 22.9% had not attended. Respondents have reported that they have attended various types of training, namely, BIM workshops, Revit, Civil 3D, Internet of Things (IoT), Construction Industry Development Board (CIDB) Green Card Safety training, Green Building Index courses and soft skill workshops. When rating the effectiveness of the training from 1 (Not Effective) to 5 (Very Effective), 71.1% of respondents gave a 4 in the rating scale, while 22.9% have rated it as 5. 8.4% rated a 3 and 1.2% rated 2, which shows that most professionals found training useful but there are still room for improvement.

The open-ended question asked and requested professionals to provide suggestions to improve current training programs. Professionals opted for a more practical and hands-on training where works are based on real-world projects, moving away from the typical classrooms. The respondents also mentioned about incorporating more soft skills activities in trainings so that they can garner skills like teamwork and leadership. They suggested for a more flexible and shorter training at night or weekends so that it would be available for workers that are working during the day. Respondents were also asked which skills they would want to develop further to grow. Most have mentioned that they would like to improve in BIM, project management, time management and soft skills as in Figure 3. This shows the importance of digital skills in this era of modern technology in the industry.

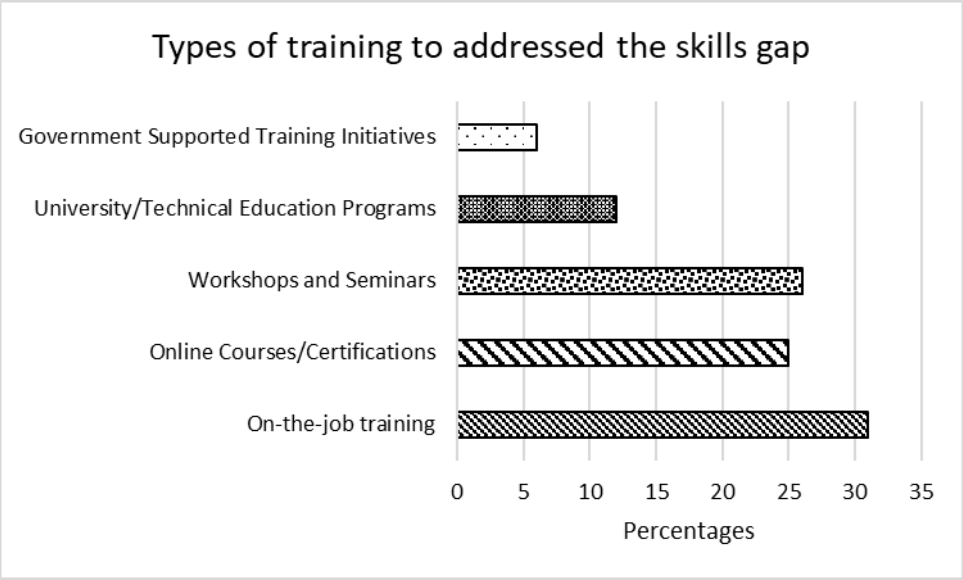

Fig.3. Training needs to addressed the skills gap

3.5 Future Needs and Recommendations

In this section, respondents were asked to rate the importance of skill sets such as digital transformation, sustainability and green building practices, safety and compliance training, soft skills and government-industry collaboration on a scale from 1 (Not Important) to 5 (Very Important). Two Likert scale questions that was designed to investigate the importance of the collaboration between

industry and educational institutions and the industry's readiness for future workforce demands. These responses include a mix of quantitative rankings and qualitative insights into how professionals intend to close the skills gap as in Figure 4.

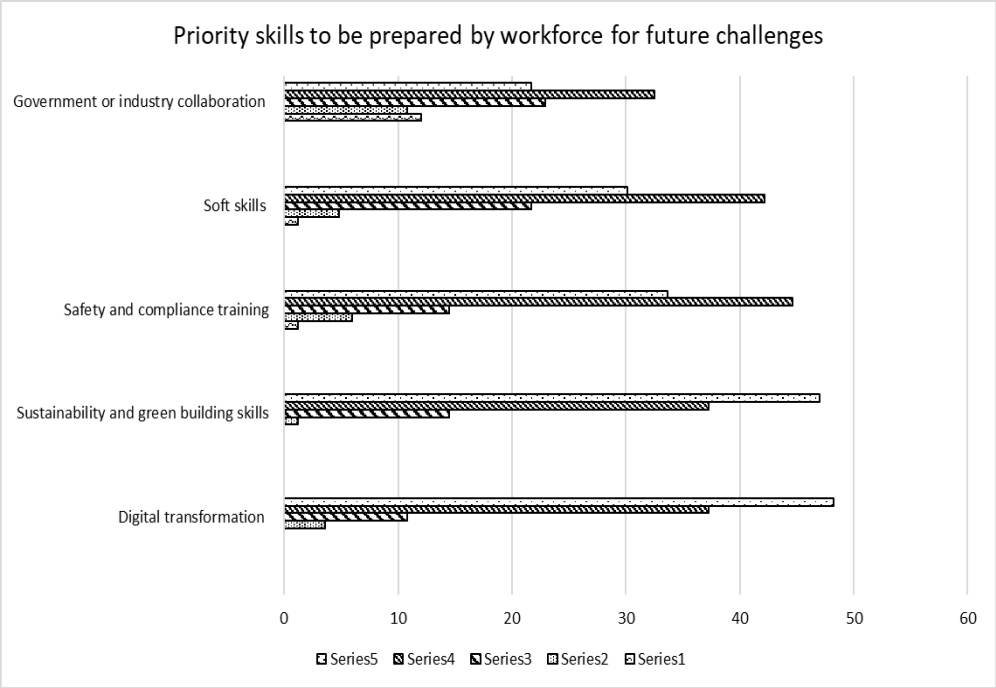

Fig. 4. Priority skills to be prepared by workforce for future challenges

Digital transformation emerged as the top priority, with 48.2% of respondents rating it as *Very Important (5)* and 37.3% rating it as 4. Sustainability and green building skills followed closely, with 47% rating them a 5 and 37.3% rating them a 4, indicating strong demand for both digital expertise and sustainable practices. Safety and compliance training also ranked highly, with 44.6% rating it a 4 and 33.7% rating it a 5, reflecting the industry's emphasis on maintaining strong safety standards. Soft skills such as communication and leadership were valued slightly less, with 42.2% rating them a 4 and 30.1% a 5. Government collaboration with the industry was the lowest priority, with 32.5% rating it a 4, 21.7% a 5, and 12% considering it *Not Important (1).*

The need for a stronger collaboration between the industry and educational institutions showed a high agreement level among respondents, with 68.7% agreeing and 26.5% strongly agreeing with the statement. However, 4.8% of respondents were neutral towards it. This shows a strong believe that the collaboration between universities and industry could bridge the gap even more due to the merging of theoretical education and practical learning. This shows that professionals would prefer more collaboration between universities and governmental bodies to enhance the real-world training demands, and it would ensure that workers would have the necessary skills to face challenges in the industry.

Nevertheless, opinions on whether the industry is properly preparing workers for future work demands were conflicted as 43.4% agreed with that and 18.1% strongly agreeing. 32.5% were neutral towards that opinion and 6% disagreed with it. This indicates that one-third of the total respondents were unsure whether the industry is properly preparing workers enough. This suggest that, while many professionals acknowledge it, concerns are still there as technological advancements continues.

4. Conclusions

In conclusion, the study has shown that there is a need for accessible trainings to ensure that the workforce is ready for future demands of the industry. These findings would provide training providers with key information so that they can alter their training syllabus in the right direction. This would allow them to create focused training programs so that workers could improve on a particular skill. The data and results can be used as a guide for future studies aimed at bridging the skills gap and improving the industry's job competitiveness.

Professionals have emphasised the importance of digital skills, project management and soft skills to stay competitive in the growing market. Some respondents have mentioned the obstacles of attending training like cost and unrelated training programs to fit their needs. Many respondents have attended training in the past five years. The most popular approach was on-the-job training, which was followed by workshops and online courses. This shows professionals prefer a more flexible and hands-on approach.

Most respondents had agreed that there is a skills gap in the industry and most agreed that it has a negative impact on project performances as it makes it difficult for employers to find qualified workers. The most critical skills gap was found to be digital skills, which was followed by project management and green building practices. Technical trade and safety were less mentioned however, which shows that digital and sustainability skills are growing in importance. These results show how important it is to bridge the skills gap.

Professionals have shown that sustainability and digital transformation skills for future workforce development are important in order to close the skills gap. Safety training and soft skills being prioritized less compared to them. Furthermore, collaboration between the government and industry was not as popular of a skill to adopt. The respondents have suggested for current training programs to be updated with contemporary technologies, to be more flexible, make cheaper courses, and make training more practical with real-world scenarios. These tactics support the goal of the research, which is to suggest useful strategies to enhance the training programs.

The majority of respondents agreed with the recommendation that employers and training providers collaborate for an accessible and useful training programs. This shows that more funding and research is required. In addition, more research should be done to look into why some professionals fail to notice and spot the skills gap. To meet growing market demands, construction industries worldwide should highlight continuous workforce development in digital, sustainable, and practical skills.

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