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**SHORTAGE OR MISMATCH: REFRAMING THE SKILLS CHALLENGE FOR
OFFSITE CONSTRUCTION DELIVERY AND RESILIENCE**

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Abstract: The global construction sectors are facing a persistent skills shortage presenting it as one of the most pressing challenges around the world. This has led to a worsening global housing crisis, housing unaffordability, continuous productivity declines and predicted severe negative impacts over the next decades along with an increased push towards factory-made buildings. As such, this study seeks to answer the research question: “how do skills mismatches and shortages affect offsite construction delivery and resilience?” The research adopted a qualitative approach to conduct a cross-country analysis of offsite construction skills in the Australian and the United Kingdom construction sectors. A critical literature review was conducted using secondary data collected from industry bodies and global reports to identify comparable employment status measures and offsite construction adoption. This was followed by an evaluation of factors that affect the uptake of offsite construction and its resilience over a prolonged period. Some of these factors include regulatory push towards industrialisation, migration policies, training, education and employment pathways to join construction from non-cognate backgrounds as well as the impact of significant workforce employed at micro, small and medium construction enterprises. This research presents initial findings with practical implications for understanding how offsite construction skills can be improved by understanding skills shortages and mismatches.

Keywords: Offsite construction; construction industry; construction skills shortage; skills mismatch

1 INTRODUCTION

The global economy heavily relies on building and construction sectors, accounting for 11% - 13% of global gross domestic product (GDP) while employing nearly 9% of the world's workforce (United Nations Environment Programme 2026). The building and construction sector representing architecture, construction and engineering is the second-largest employer in Australia, with 7% GDP contributions (Australian Bureau of Statistics 2025), 1.37 million workers representing approximately 9.3% of the workforce share and 1/13 Australians with a median worker age of 37 years (Australian Government 2026; Master Builders Association 2024). Comparatively, the construction sector in the United Kingdom (UK) reached £215.7 billion construction output (nearly 9% of GDP) with a workforce of 2.65 million, (Construction Industry Training Board 2024).

The construction sectors in both countries also faces a persistent skills shortage, requiring approximately 130,000 and 47,860 extra workers annually in Australia and the UK, respectively, in addition to those

needed to replace retirees and those leaving the industry (Construction Industry Training Board 2024; Master Builders Association 2024). These issues highlight a growing concern which has led to a worsening housing crisis and unaffordability. Since a healthy construction sector has a significant impact on overall economic performance, many researchers have recognised offsite construction involving industrialised production, as a promising solution to overcome these challenges (Fu, Chen, and Lu 2024; Wusu et al. 2025).

Compared to the rest of the world, the overall offsite construction uptake has been at a slow increment level in Australia (5-10%) and the UK (11-20%) (Goulding et al. 2023). Both countries are actively promoting modern methods of construction (MMC) including offsite construction as a means for improving construction productivity and sustainability, while reducing construction cost and waste. There are substantial government support and incentives for offsite construction adoption in both countries (Khan et al. 2026; Wusu et al. 2025), yet the rate of industry adoption has been at a lower rate in comparison. While this can be due to a myriad of reasons, this research focuses on the skills that lead to the uptake and resilience of offsite construction.

For the purposes of this paper, resilience refers to the ability of offsite construction to maintain delivery capacity when affected by skills related pressures, including shortages, mismatches and wider labour market challenges. This aligns with broader definitions of resilience as the ability to absorb and adapt to change while continuing to deliver objectives (International Organization for Standardization 2017) and as the ability to adjust under disruption (Vogus and Sutcliffe 2007). In this context, skills are not only an employment concern, but also an important factor affecting the longer-term uptake and continuity of offsite construction delivery.

From an economists' perspective, Brunello and Wruuck (2021) defined skills shortages as the unavailability of workforce at the ongoing labour market pay rate and skills mismatch as the difficulties in finding right people for the right job. In essence, skills shortage is about the quantity and lack of supply where many vacancies remain open for a longer period being unable to recruit the adequate number of workers (Master Builders Association 2024). In contrast, skills mismatch is about the quality of the available workforce where the job task requires varying levels of skilled, semi-skilled and unskilled workers who are not available in the construction industry labour market (Merryweather Powell and Shibeika 2025).

Previous research on offsite construction skills highlighted the transition from onsite to offsite (Ghaffar et al. 2022), evaluated offsite construction labour productivity (Assaad et al. 2023), quantified emerging skill needs (Ginigaddara et al. 2023), developed educational and training pathways (Yun et al. 2025) while recognising the unique challenges of human-robot integration in offsite construction (Fu, Chen, and Lu 2024). Although construction skills shortages and gaps that extend to offsite construction have received much attention and in-depth research, the concept of skills mismatch is less explored. As such, this research investigates how skill shortages and mismatches affect the uptake and resilience of offsite construction.

2 RESEARCH METHODOLOGY

Guided by Schweber and Chow (2023), this research follows a predominantly qualitative approach to answer a 'how (to account for either continuity or change)' type research question through a critical literature review. The adopted methodology is similar to an integrative review outlined by Snyder (2019) in many ways;

- i. The purpose of this literature review is to assess and critique existing literature to enable a new perspective on the topic offsite construction skill shortage vs mismatch,
- ii. Literature search is not systematic, nor limited to research papers, expanding the review to grey literature sources where appropriate
- iii. Data analysis is not limited to a particular research method and rather critically analyses literature to create new knowledge in the selected research theme

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- iv. Contributions of the review lead to novel conceptualisations extended beyond a mere synthesis of literature sources

The critical literature review focused on construction skills training and education in the UK and Australia. Resilience was used as an interpretive lens to consider how skills related issues may affect the continuity of offsite construction delivery. The study therefore explored whether addressing skills mismatches can provide a more effective pathway for strengthening the continuity and resilience of offsite construction delivery than focusing solely on overall worker shortages.

3 DISCUSSION

3.1 Education pathways

Both Australia and the UK currently consider offsite construction and MMC as an extension of traditional construction education with minimal revisions to the existing education frameworks. An evaluation of globally accredited degree programs in quantity surveying and construction management identified that less than 25% of the degrees teach offsite construction as a core subject (Ginigaddara, Gajendran, and Beard 2023). Similarly, an industry-wide survey of 978 construction engineers indicated that fewer than half have a strong understanding of offsite construction or its application in the broader construction sector (Yun et al. 2025). These findings are in line with the findings of Wusu et al. (2025) focusing on the UK construction sector. They concluded that only construction industry professionals or their allies have some level of understanding about offsite construction. This implies how the majority of trades workers and technicians in construction are uninformed about offsite construction and their potential upskilling needs.

Formal education through vocational or higher education in the tertiary education process is only one way of learning (Ginigaddara, Gajendran, and Beard 2023). In an applied sector like construction, many workers get on-the-job training after formal education and continue to improve their knowledge and learn new skills by working in the industry. Peer learning, particularly through cross education from older workers is recommended as one of the most effective ways to increase the skill level to match industry requirements (Ghaffar et al. 2022). Such learning pathways also lead to professional membership from relevant accreditation bodies related to architecture, engineering, construction, surveying and the like (Ginigaddara, Gajendran, and Beard 2023).

3.2 Skills migration

Both Australia and the UK are considered targeted countries for global skills migration. As a result, most universities in both countries offer world renowned academic programs to bring skilled and unskilled migrant workers to their countries. Additionally, the countries offer skill migration pathways as a direct response to seasonal and periodical skills shortages in the market. Australian construction sector consists of 24% of migrant workers (Master Builders Association 2024), highlighting the greater opportunities for bringing skilled offsite construction workers to the country. Despite having heavily regulated and highly monitored migration pathways, it is recorded that more than 30% of skilled migrants in Australia faces skill mismatches, particularly by being over-qualified for their positions (Tan and Cebulla 2022). In contrast, the UK construction industry has been heavily impacted by the Brexit and long-standing negative connotations about the sector, leading to exacerbated issues of skills shortages (Merryweather Powell and Shibeika 2025).

3.3 Skills transfer from other sectors

Offsite construction is inherently a convergence between factory-based production and on-site assembly supported by integrated, digital technologies. It is predominantly transforming traditional construction skills, trades and crafts towards a novel systems-based delivery option which is far different to how construction industries have been operating over the past few decades. Therefore, it is understood that offsite

construction can benefit from skill transfers from other industries such as manufacturing, software, information technology as well as mining.

To achieve net zero goals by 2050 (United Nations Environment Programme 2026), Australia has initiated their strategic plans to deviate from coal mining sectors which accounts for approximately 2% of the workforce. These workers are also being redirected towards renewable energy construction projects which heavily integrate offsite construction techniques due to their remote locations and faster delivery. However, strategic plans towards transferring mining skills towards offsite construction re-skilling pathways is non-existent. Similarly, generative AI has impacted most global sectors including many within Australia and the UK. The world has evidenced many job cuts and eradication of some supporting services due to the increasing adaptability of AI to complete mundane tasks that rely on large language models. While such roles in offsite construction (and construction) can also be subjected to redundancy, clear pathways and not evident to re-skill or up-skill these workers to join a sector that suffocates from many skills related issues.

3.4 Summary of findings

To increase the offsite construction uptake while improving industry resilience, a stronger workforce is required. While it can be argued that skilled shortage is the same as skilled mismatch, it is important to understand how these two concepts differ from an offsite construction perspective (Table 1).

Table 1: Skills shortage vs mismatch – key considerations

	Skills shortage	Skills mismatch
Problem	Not having adequate number of workers in the market, also known as the lack of supply	Workers are available, yet they are not competent enough to undertake offsite construction projects
Reason	Reluctance to join the industry, low attraction and poor retention leading to high turnover	Education gaps, strict employer filtration for migrant workers, no pathways for skills transfer from one industry to another
Features	Vacancies remain open for a long period	Being over-qualified or under-qualified without matching skilled, semi-skilled or unskilled work needs

These findings suggest that addressing skills mismatches may help ease some of the skills shortage pressures affecting offsite construction and support the resilience of offsite delivery. Within offsite construction, resilience is reflected in the ability of the workforce to adapt to evolving skill needs while maintaining productivity and delivery performance. Skills mismatches reduce the potential for achieving resilience by creating capability gaps at critical work stages of offsite construction.

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