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CITB IMPACT FUND – TIMBER IN CONSTRUCTION SKILLS DEVELOPMENT

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Abstract: The UK construction industry faces a significant skills shortage, particularly in the management and on-site delivery of timber MMC. This shortage is driven by a lack of resources, training content, and educational and career pathways for both new entrants and existing workers. This paper reports on the approach and early findings of a UK Construction Industry Training Board (CITB) Impact Fund project, “Timber in Construction Skills”, aimed at addressing these challenges. The project supports the aims of the UK Timber in Construction Roadmap, a Government-Industry Partnership launched in 2025, by creating new educational resources and improving skills pathways; developing and implementing accredited training programmes for existing and standalone educational provision; and collaborating with sector stakeholders and external partners to achieve scalable impact. This paper provides an overview of the skills gap analysis and early results, identifying gaps for educational interventions. By applying a novel AI-driven gap analysis methodology, identified competency deficiencies can be systematically translated into targeted educational interventions, supporting the management and on-site delivery of off-site-manufactured timber MMC.

Keywords: GenAI; Curriculum Mapping; Timber in Construction; Skills Gap; Timber Education;

1 INTRODUCTION

Timber-based Modern Methods of Construction (MMC) are increasingly important for addressing the UK construction sector’s key challenges in housing delivery, productivity, and carbon reduction. Although the necessary technical knowledge and industry expertise are largely in place, broader adoption of MMC depends on a workforce with the right skills. In practice, the design, management, and on-site delivery of timber MMC rely on knowledge that often differs from that found in traditional construction education. These MMC-specific skill sets are not consistently integrated into existing educational programmes, leading to skills shortages that often hinder the wider adoption of timber construction (DEFRA 2025).

The educational landscape in the UK is extensive and complex, yet it lacks clear, flexible pathways for learners to upskill and reskill. It is also unclear whether courses in further education (FE), higher education (HE), and continuing professional development (CPD) adequately prepare learners for the future. Conventional and well-established qualification standards typically formalise current occupational roles and regulatory expectations rather than emerging, innovative approaches. While the existing standards remain important, they offer limited insight into the future demands of modern, industrialised construction.

To address these gaps in existing educational provision, the CITB Industry Impact Fund project Timber in Construction Skills was launched in October 2025. Sponsored by the Construction Industry Training Board

(CITB), this industry-led initiative is carried out by a consortium of partners including manufacturers, educational institutions, and innovation organisations. Its main aim is to develop a scalable, transferable model for timber skills development that supports both upskilling the current workforce and creating future talent pipelines.

Before establishing a model for developing timber skills, it was essential to conduct a comprehensive review, or gap analysis, of the existing education and training provisions related to timber. This review was conducted using the Timber in Construction Skills Action Plan (ENU 2023) as a standard, published by Timber Development UK (TDUK) in direct response to the UK Government-endorsed Timber in Construction Policy Roadmap (TiCR) (DEFRA 2025).

The Skills Action Plan presents a sector-led framework that identifies 17 key competencies, related skills, and vital educational topics needed to develop a workforce capable of implementing timber-based Modern Methods of Construction across the UK supply chain. While the Action Plan clearly articulates the competencies required for the future workforce, there has yet to be a structured, comparative evaluation of how effectively current FE, HE, and CPD programmes address these competencies.

This paper presents the approach and early findings from a curriculum gap analysis undertaken as part of the CITB Industry Impact Fund project. A structured, AI-assisted methodology was applied to compare publicly available programme evidence against the 17-competency framework. The paper demonstrates how AI-supported curriculum mapping can streamline traditionally manual review processes and, in doing so, directly inform the development of accredited training content to address identified gaps in existing provision and ultimately respond to the growing demand for timber-based MMC.

2 BACKGROUND

The UK Government has committed to building 1.5 million new homes over the next five years (MHCLG 2024b), but current delivery methods fall well short, reaching only about half of the annual target of 300,000. In Q2 2024, building starts totalled 22,990 (MHCLG 2024a) - a 65% year-on-year decline, worsening a long-standing productivity crisis in construction. This situation is worsened by a chronic labour and skills shortage, with the sector employing 500,000 fewer workers than in 2008 (ONS 2026).

In addition to these challenges, the sector must achieve net-zero carbon emissions. The Future Homes Standard, which came into force in 2025, requires all new homes to be zero-carbon operationally once the electricity grid has been decarbonised (Future Homes Hub n.d.). Similarly, Scotland continues to work toward legislating a “Scottish-equivalent Passivhaus standard” for implementation by 2028 (Scottish Government 2023). To align climate and housing policies, the UK Government’s “Timber in Construction Policy Roadmap” (TiCR) promotes Modern Methods of Construction (MMC), especially timber-based techniques, to deliver quicker, resource-efficient, and sustainable housing while creating green jobs and strengthening domestic timber supply chains (DEFRA 2025).

Despite these efforts, timber offsite manufacturing accounts for only 8% of new homes in England, according to the Structural Timber Association (2022). The TiCR identified a lack of specialist skills, capacity, and competency across the supply chain as the main barrier to increasing timber MMC adoption. Although major housebuilders have invested significantly in timber frame manufacturing, industry evidence suggests that equivalent progress in training site-based installers, supervisors and delivery teams has been slower, creating a potential bottleneck in effective on-site implementation (ENU 2023).

Timber MMC demands specialised knowledge in material-specific construction, scheduling, and project management that differs from traditional approaches. However, no current higher education programmes provide comprehensive training in timber construction management or clear routes to professional body membership. Existing training consists of ad-hoc, non-accredited CPD modules, leaving significant gaps in the system needed to support the sector’s move towards sustainable, timber-based housing solutions.

Expanding the workforce requires inclusive recruitment, clear career pathways, and training programmes to attract diverse talent, including those from other sectors with transferable skills. The shift to off-site

manufactured systems demands new education models to reskill and upskill operatives, ensuring quality delivery and compliance with energy performance standards.

3 METHODOLOGY

Identifying opportunities for educational intervention required the research team to explore different review methods to ensure efficiency and consistency across the evaluation process. To review existing education, a common standard for comparison had to be identified. Initial desk research also identified 66 educational programmes or programme types to review for gaps in education that could support future low-carbon timber-based construction projects.

Selecting a competency framework involves reviewing existing standards to identify skills, interventions, and gaps. If the gap analysis relies on standards that do not address emerging methods, it only reflects current conditions. Existing standards from CITB and CIOB focus on current industry roles, defining skills, knowledge, experience, and behaviours needed now. They validate current capabilities and ensure compliance, but often only infer future workforce needs from current structures rather than redefine competencies. Conversely, the Timber Development UK Skills Action Plan (SAP) predicts emerging competencies in sustainability, digitalisation, and MMC, shifting the focus from validation to forecasting skills development.

With a defined framework, identifying skills gaps requires detailed comparisons of existing educational programmes. Traditional approaches to gap analysis rely heavily on experts manually comparing frameworks against subject programmes. This process is cumbersome and time-consuming, restricting the scope of comparison activities and limiting the results and future impacts (Xu et al. 2026). Additionally, different models and programmes use varying terminology to represent the same content and concepts, further complicating comparisons and requiring greater expertise.

Recent research supports the use of large language models (LLMs) in curriculum-to-competency analytics. Studies show LLMs can map diverse competency frameworks, semantically align curriculum documents, and identify gaps or weakly evidenced competencies (Jamel et al. 2024). Recent work with thousands of curriculum-competency alignments found LLMs reliably assess programme alignment and detect subtle pedagogical gaps (Xu et al. 2026). Building on this, the current study applies LLM-based competency analytics to UK construction education by comparing programme data against a defined competency framework.

A structured approach to GenAI prompts was developed to systematically compare educational programmes against the Skills Action Plan. The method aimed to ensure consistency, minimise interpretive differences among researchers, and limit the LLM to verified programme evidence. Researchers developed a series of designed prompts to standardise the analytical process across all programme assessments.

The initial phase of the process established the analytical baseline by loading the SAP into the GenAI environment. This first prompt explicitly outlined the 17 competencies within the framework and directed the model to consider these competencies as the reference standard for all later comparisons. By formalising the competency structure at the outset, the researchers ensured that all subsequent programme analyses were benchmarked against a consistent and fixed evaluative scheme. (See Figure 1)

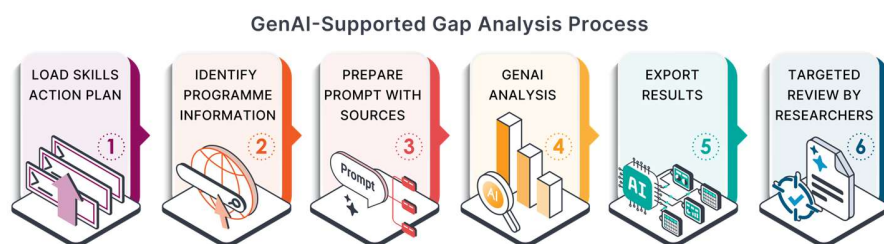


Figure 1

The second stage involved manually identifying educational programme data from publicly accessible, verifiable online sources. Researchers conducted targeted web searches to find institutional webpages, programme handbooks, module descriptors, and curriculum specifications. These sources were chosen because they provided clear descriptions of programme structure, module content, intended learning outcomes, assessment methods, and other relevant curricular evidence. Using public institutional sources ensured that all data analysed could be independently verified and traced back to its original context.

With relevant programme sources identified, the researcher inserted the verified web addresses into a second structured prompt and submitted this to the GenAI tool. This prompt instructed the LLM to compare the extracted programme evidence directly against the 17 competencies outlined in the SAP. The output was produced in tabular form, presenting each competency alongside an alignment status of Strong, Partial, or Gap. For each classification, the model also provided explanatory notes detailing the specific evidence within the programme documentation that justified the assigned status. These justification notes were especially important in enabling researchers to assess whether the model's interpretation was supported by explicit curricular evidence rather than inferred assumptions.

The resulting tables were then transferred into a spreadsheet environment for secondary review, coding, and cross-case analysis. This stage enabled researchers to conduct targeted verification of AI-generated outputs, including identifying potential misclassifications, ambiguous evidence, and recurring alignment patterns across programmes. The spreadsheet-based workflow also supported aggregation, comparisons between institutions, and the creation of descriptive statistics on competency coverage. (See Figure 2)

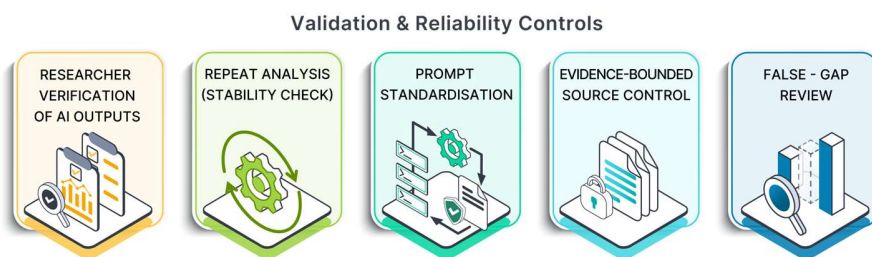


Figure 2

A key strength of this method was the use of highly constrained prompts that clearly defined both the competency framework and the evidentiary limits of the analysis. By restricting the LLM to data from researcher-verified public sources only, the approach greatly minimised the risk of hallucinated or fabricated data. Instead of letting the model produce open-ended interpretations based on subconscious background knowledge, the prompts confined the analysis to tangible evidence from identified institutional sources. This approach, which combines prompt-driven constraints and evidence boundaries, improved transparency, enhanced reproducibility, and increased confidence in the accuracy of the competency gap analysis.

4 OUTCOMES

The project remains ongoing, with programme reviews continuing using the structured, AI-assisted methodology described. To date, the research team has completed the first-stage analysis of over 50 educational programmes from FE and HE institutions. Of these, around half have advanced to the second-stage researcher verification process, in which one of the researchers manually reviews the LLM's competency classifications against the original programme evidence.

The early results suggest that the competency gap analysis is showing expected and sector-relevant patterns of educational misalignment. So far, the most significant and recurring gaps found in the programmes reviewed are in timber construction and the manufacturing of off-site components, especially where curricula do not sufficiently address industrialised construction workflows. These results support the future-oriented priorities set out in the SAP, particularly regarding MMC, offsite manufacturing, and supply chain integration.

A particularly significant finding is the limited coverage of competencies related to the full lifecycle management of timber-based off-site systems. While some programmes show partial coverage of design and structural concepts, many exhibit weak or missing treatment of broader operational processes that support successful MMC delivery. These include manufacturing management of timber components, transportation logistics, installation sequencing, site coordination, and health, safety, and risk controls for timber-based systems. The recurring nature of these gaps across multiple institutions indicates that the issue is systemic rather than specific to individual programmes.

As the dataset expands and more programmes undergo the second-stage researcher review, the outcomes will continue to evolve from a descriptive synopsis of early trends into a more robust, evidence-based comparison. However, the findings to date already demonstrate the value of the AI-assisted methodology in identifying actionable competency gaps and informing targeted curriculum interventions in response to emerging timber and MMC workforce needs.

5 CONCLUSION

This study highlights the benefits of a structured GenAI-supported approach for comparing educational programmes against an industry-defined competency framework. By integrating carefully designed prompts, verified public programme sources, and phased researcher review, the process greatly simplified what would otherwise be a very labour-intensive curriculum mapping task. The use of LLMs enhanced consistency within the research team by applying uniform definitions of competency, classification logic, and evidentiary boundaries across all programmes reviewed. This methodological consistency reduced variation in interpretation and established a more reliable foundation for comparative analysis across different institutions and programme types.

A key strength of the approach is its ability to produce evidence-based alignment outputs, allowing researchers to focus their efforts on the targeted verification of specific competencies and identified gaps rather than conducting broad manual curriculum reviews. By limiting human review to areas the LLM marks as Strong, Partial, or Gap, the methodology enables a more efficient and justifiable validation process, boosting confidence in the final classifications. Consequently, this evidence-driven gap analysis has directly guided the development of educational interventions to strengthen the most critical areas for the future growth of timber-based modern methods of construction education, particularly within existing FE and HE programmes. As the project expands, the methodology provides a scalable model for systematic curriculum improvement in response to emerging industry competency requirements.

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