

ANALYSING GREEN AND DIGITAL SKILLS IN THE TWIN TRANSITION

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Abstract

The building sector is undergoing a twin transition that combines digital and sustainable transformation. This process requires professionals with integrated green and digital skills. However, their systematic integration into education and professional practice remains limited. This paper addresses this gap through a qualitative case study based on 53 expert interviews and a validation workshop in the Cologne metropolitan region. The findings reveal significant competency gaps and form the basis for a framework supporting the integrated development of green and digital skills.

Introduction

The building sector accounts for approximately 35 % of energy consumption and 30 % of CO₂ emissions in Germany (United Nations, 2024).

To address these challenges, the sector is undergoing a twin transition, that combines digitalisation and sustainability (Hofmann et al., 2023). This transformation requires integrated green and digital skills, yet their implementation in education and practice remains insufficiently understood (Ziegler et al., 2023).

This study analyses existing and required skills and explores their integration into higher education.

Design and method

A qualitative research design combining semi-structured expert interviews and a validation workshop was applied. Stakeholders from planning, construction, operation, education, and regulation were included. In total, 53 interviews were analysed using qualitative content analysis (Kuckartz, 2018) and discussed in a workshop with 30 participants from academia and industry. In this study, green skills are defined as job-related skills supporting sustainable construction, while digital skills comprise the effective use of digital technologies and data throughout the building lifecycle, as shown in Figure 1.

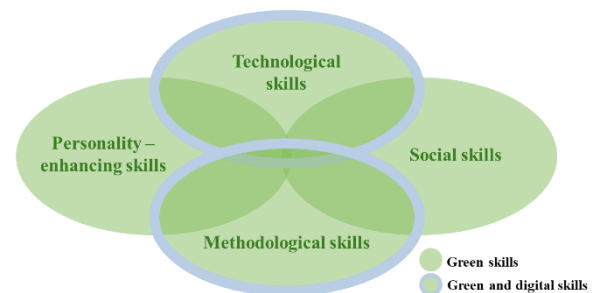


Figure 1: Used definition of green and digital skills

Results

The findings reveal a mismatch between existing and required skills. While basic technical green skills are generally present, they remain fragmented and are rarely integrated into lifecycle-oriented approaches.

A major deficit concerns methodological skills. Experts highlighted limited capabilities in applying lifecycle assessment, lifecycle costing, and data-based sustainability evaluations. Analytical and evidence-based decision-making skills are often lacking.

These deficits are closely linked to insufficient digital skills. Although digital are increasingly available, their potential for supporting sustainability goals remains underutilised. Skills related to digital planning tools, data interpretation, and simulation-based analyses are frequently underdeveloped and rarely connected to sustainability objectives.

The analysis also identified significant gaps in interdisciplinary skills. Strong discipline-specific expertise exists, but knowledge exchange across professions and lifecycle phases remains limited. As a result, coordination challenges emerge and integrated solutions are difficult to implement. Communication and collaboration skills were identified as critical requirements for successful transformation processes.

The analysis highlights the important role of higher education in preparing professionals for the twin transition but reveals significant shortcomings. Sustainability and digitalisation are often treated as isolated topics rather than integrated skills. In addition, interdisciplinary and practice-oriented learning formats remain limited, and teaching staff frequently lack up-to-date expertise. As a result, current education systems are not yet fully aligned with the competency requirements of the twin transition.

The findings indicate that the prevailing education and training systems are not yet fully aligned with the skills required for the twin transition, particularly with regard to the integration of green and digital skills as interconnected domains.

Conclusion and recommendations for action

The study demonstrates that the twin transition is constrained by a mismatch between existing and required skills. Green and digital skills should not be considered separate domains; rather, digitalisation acts as an important enabler of sustainability.

To address current deficits, green and digital skills should be embedded as cross-cutting skills throughout higher education and professional training. Key measures include:

- integration of sustainability and digitalisation across curricula
- strengthening data-driven and methodological skills
- expanding interdisciplinary and practice-oriented learning formats
- fostering close collaboration between academia and industry

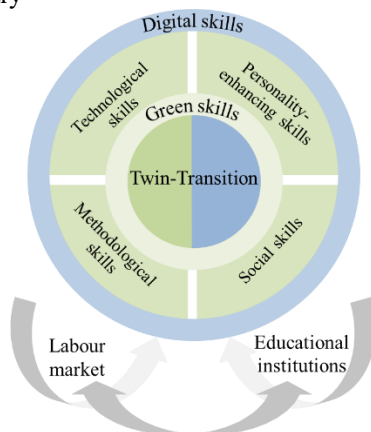


Figure 2: Framework for the integrated development of green and digital skills

The conceptual underpinnings of this integration are delineated by the framework depicted in Figure 2. It is recommended that future research efforts concentrate on the implementation and evaluation of integrated competence models.

Acknowledgments

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