Enhancing Knowledge Transfer for Sustainable Construction through Social Network Analysis

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By

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For André, Scarlett, and Jocelyn.

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LIST OF ABBREVIATIONS

BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
DGNB	Deutsche Gesellschaft für Nachhaltiges Bauen
DGNB	Deutsche Gütesiegel für Nachhaltiges Bauen
ENEV	Energieeinsparverordnung
ESG	Environmental, Social, and Corporate Governance
KM	Knowledge Management
KT	Knowledge Transfer
LEED	Leadership in Energy and Environmental Design
NDC	Nationally Determined Contributions to the Paris agreement
RICS	Royal Institution of Chartered Surveyors
SN	Social Network
SNA	Social Network Analyses
SME	Small and medium-sized enterprise
WBCSD	World Business Council of Sustainable Development
WGBC	World Green Building Council

1- INTRODUCTION

1.1. Sustainability in the Built Environment

Almost half a century has passed since the Brundtland Commission Report in 1987 (Pitt *et al.,* 2009), and many policies, legislation, and initiatives relating to environmental performance and sustainability have emerged in the meantime. In December 2019, the EU heads of state and government agreed in the European Council that Europe should be the first continent to become climate-neutral by 2050. This resulted in the Green Deal (European Commission, 2019). According to the European Climate Change Act, EU countries must reduce their greenhouse gas emissions by at least 55% by 2030, leading to the Fit for 55 Package. The Twin Transition explains how these sustainability goals can be integrated with digital transformation strategies and enables companies to work more efficiently and sustainably at the same time. The green and digital transitions are political priorities of the European Commission and the European Member States (Muench et al., 2022; Schröpfer, 2024).

At the outset of this study, in 2009, it seemed the focus of built environment stakeholders lay mainly on the energy efficiency of buildings, and most investors saw the energy-saving costs as an incentive to build sustainably. Sustainable building certificates were seen as proof of a quality-built result, which justified the extra costs of green buildings, which were around 2.5% in Europe at that time (Galbraith, 2008). Commercial and public building owners were the forerunners. In the years that followed, the term payback period became more and more important in winning over private property owners to renovate their homes in an energy-efficient way. Nevertheless, the sector moved from this economic focus on energy to a wider perspective of environmental sustainability, looking at safeguarding natural resources. Following the Paris Agreement in 2015, the member states of the United Nations adopted 17 Sustainable

Development Goals (SDGs) (UN, 2024), of which five relate to the built environment. Adapting the built environment to climate change consequences became as vital as mitigating climate change.

The WGBC stated in 2021 that 37% of annual global greenhouse emissions derive from buildings and 75% from the wider built environment. Predictions are that between 2020 and 2050, around 50% of emissions from new buildings will be from embodied sources and the other half from operational sources (WGBC, 2021). When looking at resources and pollution, 40-50% of resources extracted from global materials are used for housing, construction, and infrastructure, while building materials account for half the solid waste generated worldwide (ibid).

The environmental pillar joined the economic one, and building sustainably became mainstream in recent years. The last of the so-called three pillars of sustainability (Elkington, 1998), i.e. social sustainability, followed thereafter, with the European Commission launching the New European Bauhaus Initiative in 2020 to make the built environment more inclusive and foster cultural heritage amongst other areas (JRC, 2021).

Research projects and legislation moved from energy efficiency to nearly zero energy buildings, to climate-neutral and plus-energy buildings. Circularity is the new buzzword, looking at urban mining, buildings as material banks, and design for disassembly. Whereas throughout history, mankind has been reusing building materials, hence this movement is not as new as one might assume (WGBC, 2023). However, in 2023, the circular use of materials is not moving in the right direction, as estimates calculate the world is only 7.2% circular, which is a reduction from 9.1% circularity in 2018 (WGBC, 2023).

Construction is the second largest of the 14 industrial ecosystems listed in the European Industrial Strategy. It is dominated by SMEs and micro-enterprises, employs 25 million people, and accounts for almost 10% of total value added in the EU. The construction industry faces several challenges, including an ageing labour force and difficulties in attracting young workers. A well-trained construction labour force is one of the key factors in making a significant contribution to achieving climate targets (Schröpfer, 2024).

The green economy is defined as one in which value and growth are maximised throughout the economy while natural resources are managed sustainably. Such an economy is supported and enabled by a thriving low-carbon, environmentally friendly goods and services sector. Central to this new green economy is a dynamic design and construction sector that can greatly contribute to increasing resource efficiency and resilience to climate change. To achieve climate targets, up-to-date knowledge and skills of professionals in this sector are essential, not only for the transition to a green economy but also to attract more skilled labour to the sector. However, the construction sector is struggling to meet its carbon reduction targets due to labour shortages and skill gaps (Schröpfer, 2024).

There seems to be the assumption that each construction stakeholder group has the capacity and knowledge to build sustainably. Yet, despite the legal targets, still, only a small number of professionals in the industry possess the specialised knowledge and experience to design and operate sustainable buildings successfully (Cromwijk et al., 2017; Williams, Dair, 2007; Nelson, 2007; WBCSD, 2009). Moreover, there seem to be difficulties in the process of putting this new knowledge on how to build sustainably into practice (Ugwu, 2005). Previous research has shown that for professionals the main barriers to adopting sustainable building techniques are personal know-how and commitment (WBCSD, 2009), which reflects not only a lack of training and education in relevant techniques (Dixon, Colantonio, Shiers, 2008), but also personal commitment and a supportive environment and business acceptance.

The level of complexity in projects, where the goal is to deliver a ‘green building’, is higher than in standard ones (Myers, 2008). This is due to the increased number of people involved, but also because of the nature of technical knowledge required. Furthermore, sustainable buildings require more and more high-tech components, which are supplied by specialised companies, e.g., for renewable energy solutions. Hence, the supply chains are more distributed and intricate than before (Williams, Dair, 2007). Thus, various sorts of new services and consultancies become more important, as a high level of expertise is required for solving the complex problems of ecological optimization (Rohrbacher, 2001; Williams, Dair, 2007).

The EU has funded a variety of research projects, and coordination and support actions to map existing skills, such as the Construction Blueprint project or PROF/TRAC, and to foster up-skilling within all professions in the construction sector, such as ARISE and BUS-GoCircular, as only a highly-skilled construction labour force can deliver on climate targets.

There have been several studies comparing the actual performance of sustainable buildings with their intended one, revealing differing results (e.g. Burman et al., 2018, Hinge *et al.,* 2008; Robinson, 2008). Bordass *et al*. (2004) argue that there are many potential reasons for the performance gap that can be divided into four main categories linked to the life cycle stage of the building.

- Project initiation
- Design stage
- Construction and commissioning
- In-use

This book explores the third one, the construction stage, in order to examine the varied perceptions and practices of sustainability knowledge and skills among construction project participants, advocating for a better understanding of knowledge transfer (KT) dynamics to ease the workflow and ensure higher sustainable building quality standards.

1.2. Transferring Sustainable Construction Knowledge and the Social Network Analysis Approach

There is a very diverse range of professions within the construction sector, all carrying different kinds of knowledge that contribute to the project. As the diversity of knowledge is one of the main factors for innovation (Cohen, Levinthal, 1990), its effective management plays a vital role in gaining a competitive advantage (Sharkie, 2003). This is of greater significance in a project-based sector such as the construction industry,