

Beyond SECI Model: Custodian–Successor Roles in TK Transfer in Construction Academia

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Abstract: This paper presents the first results of a doctoral research project on the management of scientific tacit knowledge of employees with long scientific seniority (LSS), defined as 25+ years post-doctorate, focusing on knowledge transfer in the academic environment related to construction. The primary goal of this doctoral research is to create a model that supports the transfer of LSS tacit knowledge to other employees. The research question is: How should the tacit knowledge of LSSs be managed to preserve and pass their legacy on to younger generations? The SECI knowledge spiral model was adopted as the foundation for the development of the proposed model. However, the classical SECI framework has been extended by incorporating two critical roles: The Custodian, responsible for preserving, structuring, and documenting the tacit knowledge of LSS; and The Successor, an individual actively acquiring and applying tacit knowledge in practice, ensuring its continuity in scientific work. The model was developed based on a triangulated research approach combining an online survey, in-depth interviews, and an extended literature review. Thirteen research organisations participated in the study: six from Poland and seven from Europe. 52 completed surveys were obtained (100%) and 51 interviews were conducted (98%). The results were subjected to both qualitative and quantitative analysis. The proposed model operationalises tacit knowledge transfer through a structured process aligned with the SECI phases: socialisation, externalisation, combination, and internalisation, adapted to the realities of scientific institutions. It introduces mechanisms for actively acquiring and preserving knowledge through a combination of traditional methods such as mentoring and coaching, and modern technological solutions, ensuring that the legacy of experienced researchers remains accessible and functional for future generations. This study contributes by proposing a structured, role-based framework that enhances the practical applicability of tacit knowledge management in construction academia. The paper concludes by discussing the practical applications of the model and its potential for broader adaptation to knowledge-intensive institutions.

Keywords: Tacit knowledge management, Long Scientific Seniority (LSS), Knowledge transfer, Construction academia, SECI model adaptation

1. Introduction

1.1 Background

Tacit knowledge (TK) has always been an asset for a competitive advantage. In times of advantageous technological solutions, we look at the organisation's resources more carefully than before. In the case of science, the situation is slightly different; there are some commonly known foundations, but there is also tacit knowledge relating strictly to science. This study aims to introduce the concept of scientific tacit knowledge in construction and a model supporting its transfer.

The research topic stems from the author's professional experience related to her work at the Building Research Institute (ITB) since 2016. The ITB is an esteemed Polish institution with a rich 80-year history of pioneering construction research that maintains a diverse team of over 300 employees. Two opposing mechanisms of tacit knowledge management have been observed in the ITB. The first mechanism concerns the challenges of transferring knowledge from senior researchers because their impending retirement may result in a significant loss of expert knowledge. The second illustrates the successful acquisition of tacit knowledge through interactive observation, a process that the author experienced personally during her cooperation with the scientific secretary of ITB, an outstanding scientist in the field of civil engineering.

The main focus of this study is an employee with long scientific seniority (LSS), an individual who obtained a PhD degree at least 25 years ago (for this study, 1999 and earlier), and tacit knowledge relating to the field of construction science. This field is characterised by a conservative and formal approach, resulting from the obligations involved in designing and erecting buildings. This attitude can hinder knowledge diffusion. In addition, tacit knowledge can be an essential resource for further development of construction science.

1.2 Research Focus

1.2.1 *Scientific gap*

The noticed scientific gap refers to the primary process of sharing scientific tacit knowledge (and, more broadly, other processes) by LSS employees, who, thanks to their unique life, professional, and scientific

experience, have unique scientific tacit knowledge, which translates into high scientific and research potential. The determinant here is not the employee's age, but his or her scientific experience counted from the year of obtaining a doctoral degree. Construction is a field characterised by formality and conservativeness because of the obligation to design and erect buildings. In this context, the tacit knowledge of construction scientists, which is a combination of experience, skills, and engineering intuition, is an important resource that can influence the development of scientific knowledge in the field of construction.

1.2.2 Research problem definition

The primary aim of this study was to develop a model that will support the management of scientific tacit knowledge of LSSs in scientific institutions in the field of construction science. This tacit knowledge can be a foundation for future studies, giving younger researchers a plethora of guidelines and ways of conducting research that have been proven through time. The main research question of this study is: "How should the tacit knowledge of LSSs be managed to preserve and pass their legacy on to younger generations?"

2. The Theoretical Foundations

2.1 The SECI Model

Nonaka and Takeuchi's (1995) SECI model was chosen as the best model for managing and transferring tacit knowledge. It conceptualises knowledge creation as a dynamic and continuous process, structured into four modes of knowledge conversion: Socialisation, Externalisation, Combination, and Internalisation. Socialisation involves sharing tacit knowledge through shared experiences, whereas Externalisation transforms tacit knowledge into explicit concepts using dialogue, metaphors, and models. Combination integrates and systematises explicit knowledge to create new knowledge structures, whereas Internalisation enables individuals to absorb explicit knowledge and convert it back into tacit knowledge through practice and experience. The model emphasises the interplay between individual and collective learning processes, highlighting the importance of context, interaction, and organisational support in fostering innovation and knowledge retention.

2.2 Scientific Tacit Knowledge

Several studies on scientific tacit knowledge (STK) exist in different research contexts but not specifically in construction. Collins (2001) indicated that tacit knowledge is essential for replicating complex scientific experiments, particularly in physics. He highlighted personal contact and social interactions, particularly in complex experimental settings. Senker (1995) associates' tacit knowledge with cognitive concepts, such as schemata, paradigms, and mental models. Starikova and Sereda (2023) suggest that tacit knowledge is structured according to specific problems, indicating a systematic role in scientific cognition. Carsten Conner et al. (2018) emphasise the role of mentorship and apprenticeship, primarily associated with being a field scientist. The author defines scientific tacit knowledge as subjective knowledge inextricably linked to the researcher and the scientific context in which they operate. It is acquired in the process of scientific and cognitive studies and research, including experiences, experiments, trials, informal observations, laboratory or field practices, and conclusions, reflections, and value judgments collected on this basis. It manifests itself as a subjective view and assessment of an objectified research process aimed at reaching the essence of scientific truth, influencing the findings of the process. It includes practical skills, research strategies and procedures, and contextual and interpretative understanding, which are crucial for conducting research but are difficult to convey to others. No publications were found referring to scientific tacit knowledge in construction. However, it should be noted that the definition of tacit knowledge in construction has been defined by Pathirage et al. (2008) as "understanding, abilities, skills and experience of the person concerned; often expressed in action as thoughts, viewpoints, evaluations, and advice; produced and acquired by past experiences [...]".

3. Methods

3.1 Research Design

A qualitative approach was adopted in this study. The following methods have been utilised:

- Review and critiquing the literature
- Online questionnaires (pilot and main survey)
- In-depth interviews
- Literature review

The study employs methodological triangulation (Denzin, 1978)—combining an online survey with in-depth interviews—and theoretical triangulation by contrasting the empirical results with insights from a focused literature review on barriers to tacit knowledge management in academic settings

The pilot study was conducted in December 2023. The main online survey was conducted from March 2024 to November 2024. The in-depth interviews were conducted from April 15th, 2024, until March 11th, 2025.

3.2 Sample Selection

The research has been conducted across 13 scientific institutions, six from Poland and seven from European countries. Five research institutes were involved (two from Poland and four from Europe) and eight construction faculties of polytechnics/universities. A purposive non-random sampling strategy was adopted, which included:

- 16 LSS individuals
- nine individuals serving as LSS leaders, L-LSS
- 27 individuals cooperating with LSS, C-LSS

The pilot online survey was conducted in one Polish research institute, and the main survey and the in-depth interviews were conducted in all 13 scientific institutions.

3.3 The Online Survey

Firstly, the anonymous pilot survey was conducted in one Polish institution (Tomiczak, 2024). As a result, some changes were introduced to the actual questionnaire, adding more context and detailed descriptions to ensure a better understanding of the questions. The actual online survey was designed in Polish and English using the startquestion.com website. The survey questionnaire consisted of 94 questions divided into five Areas: I. Statements concerning the awareness of hidden knowledge; II. Statements concerning personal motivation to share (or not) the LSS persons' tacit knowledge; III. Statements concerning traditional vs innovative approach; IV. Statements concerning the organisation's support for knowledge sharing; V. Statements concerning generation diversity management. The respondents were asked to rate the statements on a Likert scale (1-5), where one means "I strongly disagree" and five means "I strongly agree." There were no restrictions on the time needed to complete the survey, and the survey was anonymous. As there were three different groups of respondents, the questions in the first two Areas were differentiated according to the role of the individual. The remaining three Areas were identical for all the groups. At the end, there was a space for comment on the survey, and so-called metrics for each group. The questionnaire was sent as a PDF document a week before the link to the survey was sent so the individuals could have more time to familiarise themselves with the statements. The main goal of this survey was to explore how the LSS persons and their knowledge are perceived in the construction academia environment. Based on the results from this survey, the questionnaire for in-depth interviews was designed.

3.4 The in-depth Interviews

The questionnaire for the in-depth interviews, in Polish and English, consisted of a glossary of terms used in the interview and seventeen open questions. There were two versions of the questionnaire: one for LSS persons and one for leaders and co-workers of LSS persons. The questionnaire was sent to an individual a week before the interview. The online interviews were conducted when only one individual from the institution was involved in the interview, or there were unforeseen problems. The maximum assumed duration of the interview was 2.5 hours. The main goal of the interviews was to deepen the understanding of the LSS's role in the organisation and the ways of involving LSS persons in the daily activities connected to sharing tacit knowledge – from different perspectives, but also to understand the impact of the organisational environment.

3.5 The Literature Review

Two databases were used for this review – Scopus and Web of Science (WoS). The research question was: "What are the key challenges and barriers in the application of knowledge management in research and academic institutions, and how do they vary across different employee groups and knowledge-intensive roles?" The following inclusion criteria were used: only papers in English published between 2013 and 2025; Areas: Business, Management and Accounting, Social Sciences, Decision Sciences, Psychology, keywords: "knowledge management," "knowledge sharing," "knowledge transfer," "knowledge-sharing," open access: green and gold. The exclusion criteria were Areas of Computer Science, Economics, Econometrics and Finance.

The result in Scopus was 991 papers. Then, abstracts of those papers were screened using the keyword “knowledge management” in the title or abstract (using the Zotero tool). The result (updated on March 3rd, 2025) was 457 papers. Twenty-six articles were removed due to unavailability of the full text. In the next stage, 431 papers from the Scopus database were considered. The result of the research in the WoS database was 65 papers. After removing the duplicates (four papers) and one retracted paper, 491 papers from both databases were selected for the deeper review.

4. Results

4.1 The Research Sample Structure

Fifty-two individuals from 13 institutions took part in the study. 37% of participants were from European institutions, and 63% were from Polish institutions. Below (Fig. 1, Fig. 2) is the summary of data characterising the research sample in more detail.

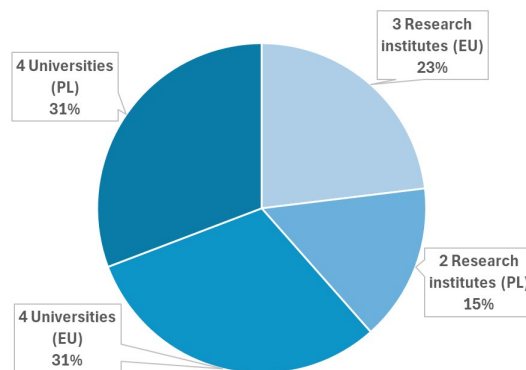


Figure 1: Research sample structure by institution and region

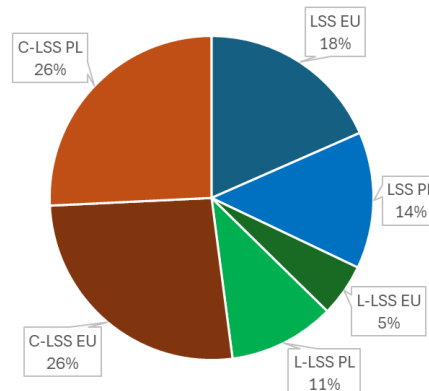


Figure 2: Groups of participants split

The smallest group of respondents is the leaders of LSS persons due to the specific nature of the university's activities, where the LSS person often serves as a leader. It should also be noted that some European institutions were represented only by one individual - two LSS and one C-LSS person.

4.2 Survey Results

A complete set of 52 completed questionnaires from thirteen institutions was obtained: 33 from Poland and 19 from European institutions. There is a common agreement that the LSS person is an authority and an expert in the field of construction – their tacit knowledge is essential, they have unique skills that are very helpful for the team, and their knowledge and experience are valuable as the foundation for the future development of younger generations. The responses of co-workers of LSS persons in European institutions were slightly different from those of other groups – the responses “I don’t know” were more frequent here. The main discrepancies in the responses were Area I. (Awareness of hidden knowledge) and Area II. (Personal motivation to share (or not) LSS’s hidden knowledge). These themes were then developed through in-depth interviews. There was a general agreement between Polish and European institutions regarding the statements in Area III. (Traditional vs. innovative approach), Area IV (Organisation’s support for knowledge sharing), and Area V. (Generation diversity management).

4.3 IDI Results

Fifty-one interviews were conducted: 46 on-site (90%) and five online (10%) interviews using the MS Teams application. Fifty interviews were recorded, and transcription was performed using the AI tool Turboscribe, adding notes from the interview that was not permitted to be recorded. The interviews revealed key insights into tacit knowledge transfers. Respondents emphasised the fundamental role of effective communication and informal interactions in transferring TK. Mentorship, especially through joint projects, observation, and structured support, was considered central. Institutional support was highlighted, mainly in recognising and rewarding LSS persons and providing networking platforms and interdisciplinary collaboration. The participants emphasised that TK is deeply rooted in intuition and the ability to recognise patterns, which enables experienced researchers to foresee long-term scientific trends. There is also a need to develop new knowledge documentation methods including digital repositories and AI-driven platforms. Additionally, encouraging curiosity-driven questioning and interdisciplinary collaboration serves as a catalyst for innovation.

4.4 Literature Review Results

After screening 491 papers by Elicit, 40 were analysed using the tool. Subsequently, the Excel file generated by Elicit was manually reviewed, and seven publications that best matched the research criteria were selected. Five of them are strictly academic environment, one focus on engineering industries and one is about knowledge hiding. The main findings, with repeated barriers described by various authors, are in the Table 1. Additionally, Riege (2005 as cited in Liu, 2021) indicated low awareness of the value of knowledge and problems resulting from diversity (age, gender, experience) as possible barriers. Mabey and Zhao (2017) explored five paradoxes of knowledge exchange, of which *Paradox 1: the more knowledge is formally managed, the less likely effective knowledge exchange will occur* is especially worth noticing.

Table 1: Repeating barriers in sharing tacit knowledge as indicated by various authors

Barriers in sharing tacit knowledge	Authors
Lack of top management support	Kanyundo et al. (2023), Fullwood et al. (2019), Thi Chung & Thi Tram Anh (2022)
Lack of trust	Fullwood et al. (2019), Thi Chung & Thi Tram Anh (2022), Riege (2005 as cited in Liu, 2021)
Lack of time	Fullwood et al. (2019), Riege (2005 as cited in Liu, 2021)
Lack of motivation / rewards	Kanyundo et al. (2023), Thi Chung & Thi Tram Anh (2022), Riege (2005 as cited in Liu, 2021)
Cultural (organizational) problems	Fullwood et al. (2019), Riege (2005 as cited in Liu, 2021)
Problems with organizational structure	Fullwood et al. (2019), Alves & Pinheiro (2022), Riege (2005 as cited in Liu, 2021)
Employee reluctance to share knowledge	Kanyundo et al. (2023), Fullwood et al. (2019), Riege (2005 as cited in Liu, 2021)
Importance of direct (face-to-face) contact	Alves & Pinheiro (2022), Mabey & Zhao (2017), Fullwood et al. (2019)

5. Presentation of the Model

5.1 Key Roles in the Model

Based on the survey, interviews, and literature review results, new roles have been defined for the SECI model to transfer the scientific tacit knowledge (STK) of persons with long scientific seniority (LSS), also defining the LSS person criteria in the field of construction science in more depth.

The LSS person is an individual with extensive research experience (over 25 years since obtaining a PhD) and scientific practice who, through long-term scientific activity, has acquired unique tacit knowledge in the field of construction. The tacit knowledge of LSS individuals includes the ability to interpret data and derive conclusions deeply; a profound contextual and interpretative understanding of scientific processes; and unique technical competencies resulting from years of observation, experimentation, and solving scientific problems. Common characteristics of LSS persons are advanced formal education in construction (and related fundamental sciences) in-depth knowledge of scientific literature related to construction; the ability to recognise patterns and structures related to science; the ability to simplify complex statements through the

use of analogies and metaphors related to everyday life; extensive experience in expert evaluations, meaning the practical verification of scientific theories and an extensive network of professional and scientific contacts.

The Successor regards the LSS person as a master and mentor, seeking to acquire the LSS's tacit knowledge because they consider it valuable and necessary. The Successor recognises the need to utilise this knowledge for personal and scientific development, including their own fields of research. The Successor intends to and declares a commitment to continuing the LSS approach: thoughts, ideas, and paradigms.

The Custodian values LSS tacit knowledge and strives to collect and preserve as many resources documenting this knowledge as possible. The main duties of the Custodian include managing digital libraries containing recordings of LSS seminars, lectures, webinars, podcasts, and interviews; collecting and organising LSS scientific publications, aiming for their complete digitisation; recording and integrating into the system's informal practices or statements conveyed by the Successor, structuring, sorting, and categorising them; and disseminating the LSS's legacy.

The Leader is the direct supervisor of the team, in which the LSS, Successor, and Custodian work. As the primary representatives of the employing institution, they are responsible for the organisational forms and conditions of collaboration, including technological aspects. The main tasks of the Leader include identifying and recruiting participants of the process; creating a space for knowledge exchange by organising various forms of interaction—both individual and team-based; supporting the knowledge transfer process by selecting technological tools, establishing rules for knowledge documentation, organising meetings in on-site, remote, and hybrid modes, and defining online and offline communication channels; and fostering an organisational culture that promotes knowledge exchange.

5.2 Model Description

Following the classical SECI model, each phase was assigned specific roles, activities, and tools to transfer the hidden knowledge of the LSS person.

SOCIALISATION is a phase in which the scientific tacit knowledge of the LSS person transforms into the scientific tacit knowledge of the Successor. The main goal of the socialisation phase is for the Successor to assimilate LSS tacit knowledge through shared experience. **EXTERNALISATION** is a phase in which the scientific tacit knowledge of the LSS person transforms into scientific explicit knowledge. The main goal of this phase is to trigger scientific tacit knowledge through conversations and discussions between the LSS person and the Successor. **COMBINATION** is a phase in which the scientific explicit knowledge of the LSS person transforms into scientific explicit knowledge. Scientific tacit knowledge has been externalised, allowing the Successor to develop new knowledge based on it. A Custodian is responsible for the storage and dissemination of the LSS person's knowledge. **INTERNALISATION** is a phase in where scientific explicit knowledge gained from the LSS person transforms into scientific tacit knowledge of the Successor. The Successor can convert LSS's scientific tacit knowledge, enriching their own tacit knowledge and laying the foundation for new scientific knowledge in the field of construction science. The roles and main tasks in each phase of the SECI model are presented in the Table 2 below.

Table 2: Role Distribution in the Author's Model of Scientific Tacit Knowledge Transfer

ROLE	SOCIALISATION <i>tacit → tacit</i>	EXTERNALISATION <i>tacit → explicit</i>	COMBINATION <i>explicit → explicit</i>	INTERNALISATION <i>explicit → tacit</i>
LSS PERSON	Act in accordance with their STK and simultaneously share it through mentoring, joint activities, observation, and informal conversations.	In response to the Successor's questions, they explain informal practices, provide a research context, and explain their principles of conduct. As a result, there is a joint reflection with the Successor. They conduct seminars where they share their STK with the broader community.	Provide written but unpublished materials related to scientific activities. Review materials prepared by the Custodian and Successor. Support knowledge classification and structuring.	As a mentor, they help interpret past research failures and support the application of knowledge in practice. Adapt their researcher's workshop concerning the knowledge acquired from the Successor and the Custodian (learns from students).

ROLE	SOCIALISATION <i>tacit → tacit</i>	EXTERNALISATION <i>tacit → explicit</i>	COMBINATION <i>explicit → explicit</i>	INTERNALISATION <i>explicit → tacit</i>
SUCCESSOR	Learn through observation, collaboration, and participation in research activities alongside the LSS.	They trigger the LSS's STK by asking questions. It leads to joint reflection with the LSS. Together with the Custodian, they document and preserve STK acquired through observation, collaboration, and conversations.	Integrates scientific knowledge from various sources, including the LSS's STK, and creates its own tools and procedures. They categorise and organise the documented STK, adding structure and classification. Support the Curator in developing training and information materials on the LSS's STK.	Applies LSS's methods in practice and transforms explicit knowledge into tacit knowledge through experience and independent research activity - automating activities acquired from the LSS. Develop their own STK. Eventually became a <i>mentor</i> in a chosen area for less experienced staff.
CUSTODIAN	Observe the collaboration between LSS and Successor. Take notes of the remarks.	Record seminars led by the LSS. Together with the Successor, document STK (including procedures, principles, and checklists).	Digitises and provides access to materials related to LSS's STK. In cooperation with the LSS and Successor, develop training and informational materials.	Acquire competencies in preserving and disseminating LSS's STK. Improves own methods of handling STK. Eventually became a <i>scientific knowledge architect</i> .
LEADER	Create organisational conditions and environment for collaboration between LSS and Successor; promote a culture of knowledge sharing and intergenerational cooperation.	Initiate and organise seminars conducted by LSS. Provide necessary tools to preserve acquired STK. Motivates process participants to share knowledge.	Oversee the collection and integration of explicit knowledge within the institution; ensure alignment with knowledge management strategy. They monitor the process of transforming data into organisational knowledge – e.g., reports, guidelines, and regulations. Provide the necessary tools.	Implement documented STK as organisational standards, update team and research management strategies. Evaluate the effectiveness of the process.

Table developed by the author based on the SECI model (Nonaka & Takeuchi, 1995) adapted to the context of scientific tacit knowledge transfer in construction academia.

5.3 Organizational Environment

In an organisation, several variables can influence the effectiveness of the model. A culture of openness, stable employment, active leadership, flexible structures, and incentive systems support this process. Conversely, siloed thinking, high staff turnover, disengaged leadership, bureaucratic structures, lack of recognition, inadequate infrastructure, and generational or technological resistance can significantly hinder knowledge-sharing and succession efforts.

6. Discussion

This study highlights the importance of tacit knowledge transfer within construction academia and the necessity of a structured, role-based approach. Informal mechanisms such as observation, mentoring, and shadowing remain central to successful knowledge transfer. Institutional support, including leadership engagement and technological tools, is crucial for preserving the scientific legacy of employees with long scientific seniority (LSS). The proposed Custodian–Successor model adapts the SECI knowledge creation process to the specific requirements of construction science.

The literature review (Section 4.4) identified several organisational, cultural, and individual barriers to tacit knowledge sharing. These include lack of leadership support (Kanyundo et al., 2023), organisational culture issues (Fullwood et al., 2019), limited awareness of knowledge management importance (Kanyundo et al., 2023), and the critical role of trust and face-to-face contact (Thi Chung & Thi Tram Anh, 2022; Alves & Pinheiro, 2022; Mabey & Zhao, 2017).

The findings of this study largely confirm these observations. Participants indicated that leadership engagement and organisational support play crucial roles in facilitating tacit knowledge transfer. Similar to

Kanyundo et al. (2023), a lack of formalised structures and incentives was perceived as a barrier. However, the study context in construction academia highlighted that while leaders' presence is important, it is their integrity and ability to foster an environment of collaboration — rather than traditional hierarchical authority — that enables effective knowledge sharing, aligning with Fullwood et al. (2019).

Trust, extensively discussed by Fullwood et al. (2019) and Thi Chung & Thi Tram Anh (2022) as a key enabler of knowledge sharing, was also relevant in this study. However, the findings suggest that among Long Scientific Seniority (LSS) persons, trust developed naturally through long-term cooperation, shared experience, and professional reputation. In this group, trust was an intrinsic characteristic rather than externally enforced. It should be noted, however, that broader barriers related to trust and willingness to share knowledge may still exist within the wider construction academia environment, beyond the LSS population analysed in this study.

The importance of face-to-face interaction and informal encounters in promoting tacit knowledge sharing, as stressed by Alves & Pinheiro (2022) and Mabey & Zhao (2017), was strongly confirmed. Participants consistently emphasised the role of joint projects, direct mentoring, and daily collaboration as crucial mechanisms for transferring non-codified expertise. These findings also reflect the paradox described by Mabey and Zhao (2017), where increasing formalisation of knowledge management can reduce the effectiveness of knowledge exchange. The Custodian–Successor model addresses this challenge by structuring support roles while preserving the informal, relational nature of tacit knowledge transfer.

Organisational structure was perceived as supportive of knowledge sharing when flexible and integrative, resonating with the findings of Alves & Pinheiro (2022). However, the lack of formally assigned roles or programmes for structured transfer of tacit knowledge was evident. While the existing literature addresses informal mentoring and communities of practice (Mabey & Zhao, 2017; Fullwood et al., 2019), no explicit role-based framework had been proposed.

Therefore, a significant contribution of this study is the introduction of the Custodian and Successor roles, operationalising tacit knowledge transfer in construction academia. Unlike previous approaches focusing on environmental factors or informal practices, this model offers a structured pathway for managing and sustaining scientific tacit knowledge within institutions.

7. Conclusions

7.1 Main Conclusions

The main conclusions of this study are as follows:

- This study confirmed that LSS employees often do not perceive their scientific tacit knowledge as unique or require structured preservation. This highlights the need for awareness-raising efforts by institutions.
- Informal learning mechanisms, especially observation, shadowing, and everyday cooperation, remain critical for internalising tacit knowledge. Organisations should cultivate environments that enable natural interactions.
- Institutional support, both cultural and infrastructural, is essential for effective tacit knowledge transfer, including providing appropriate tools, time, and incentives.
- Technological tools such as digital repositories and AI-based platforms should complement interpersonal transfers by capturing elements of tacit knowledge that may otherwise be lost.
- A new role-based model for scientific tacit knowledge transfer was developed based on the SECI framework and was adapted to the context of scientific institutions in the construction field. It defines four complementary roles: LSS (knowledge holder), Successor (learners and integrators), Custodian (preservers and disseminators) and Leader (facilitators and organisers). The success of tacit knowledge transfer depends on the synergy between the four roles. Each actor has distinct tasks that must be supported structurally, technologically, and culturally within the organisation.
- Leadership engagement is a fundamental factor. Without clear prioritisation from leaders, the transfer of tacit knowledge may remain incidental rather than strategic, limiting organisational value and sustainability.

7.2 Limitations

This study has some limitations. First, the research was mainly qualitative, and the participants' statements, despite their efforts, could be subjective. Second, the research focused on scientific institutions related to

construction in Poland and Europe, which may not translate directly to other geographical and scientific areas. Third, the proposed role-based model has not yet been tested under practical conditions; therefore, its effectiveness remains to be verified under real institutional conditions.

7.3 Implications and Future Research

The results of this study have theoretical and practical implications. The proposed role-based model offers a structured approach to managing scientific tacit knowledge, especially in scientific institutions in the field of construction. Institutions can use this framework to design more purposeful and sustainable knowledge transfer processes, particularly when working with LSS employees. The author plans to test the model in a pilot scientific unit to assess its effectiveness.

Future research directions may include, among others, the role of digital and AI-based tools in supporting the transfer of tacit knowledge, and the role of leadership styles and organisational culture for the transfer of tacit knowledge in the realities of the 4.0 economy and increasingly common remote work.

Acknowledgments

The work is financed from the Building Research Institute's (ITB) own research fund, SN-001.

Ethics declaration: Ethical clearance was not required for the research

AI declaration: I used the following AI tools in the development of the paper: Turboscribe (turboscribe.ai), Elicit tool (elicit.com), ChatGPT (chatgpt.com), and Grammarly. Turboscribe was used to prepare transcripts from previously recorded interviews in English and Polish. Transcriptions were performed in English and Polish languages. Elicit was used to screen papers selected manually by the author from the Scopus and WoS databases. During the analysis process, Elicit was used again to indicate papers that best matched the research question with manually added criteria. Afterwards, the report prepared by Elicit was used to identify the main themes, including citations of the papers. The author read the papers indicated in the References section, and the conclusions were added to the main findings of the literature review. ChatGPT was used to determine the style of the references, edit and paraphrase the selected content. Grammarly was used to check linguistic correctness - spelling, punctuation, and grammar, followed by native-speaker proofreading. AI tools are used solely as support instruments, not as original content sources or scientific opinions.

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