

Enhancing Knowledge Legacy: Strategies for Employees with Long Scientific Seniority in Construction Academia

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Abstract: This paper presents the results of a pilot survey conducted as part of a doctoral research project on the management of 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. This planned research aims to identify the best methods to support the dissemination of tacit knowledge of LSS employees among employees of other generations. The primary goal was 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? A pilot online survey was conducted with three groups of respondents: LSSs, their leaders (L-LSS), and co-workers (C-LSS). The anonymous survey included 72 statements in five areas: 1. awareness of tacit knowledge; 2. personal motivation to share tacit knowledge; 3. the traditional approach versus the innovative approach; and 4. organisational support for knowledge sharing; 5. management of generational diversity. The first two areas contained different questions for each of the three groups, whereas areas 3–5 contained identical survey questions. Responses were recorded on a five-point Likert scale. The pilot study involved research institute employees who volunteered to participate. The study sample consisted of 22 participants. The group of respondents comprised four generations. The lowest mean (below 3.0) concerned statements in Areas 2 and 4. Similarly, a median (equal to 3) was obtained for these areas. The remaining areas had a mean of 3.1 or above, with a median of 4. The standard deviation ranged from 0.93 (Area 3) to 1.25 (Area 2), which indicates that Area 2 (personal motivation to share tacit knowledge) and Area 4 (organisational support in sharing knowledge) are important areas for further analysis. The next step (February 2024) will be to conduct an online survey of two technical universities and two research institutes in Poland, followed by in-depth interviews (spring/summer 2024). The same procedure will be used for all the four European institutions (2024). The value of this study lies in determining the best practices for generational tacit knowledge sharing.

Keywords: Tacit Knowledge Management; Long Scientific Seniority (LSS); Knowledge Transfer; Generational Diversity; Construction Academia; Tacit Knowledge Dissemination.

1. Introduction

1.1 Background

Knowledge management and tacit knowledge are well-known among researchers. From works of Polanyi (1958) and Drucker (1959), Nonaka et al. (1994), and Prusak et al. (1998) to more recent works like Dalkir (2017), to name a few. There are also articles discussing possible futures in this field, including collaboration with artificial intelligence, presented by Bencsik (2021). It is also a topic presented on ECKM by Zabeda et al. (2023) and Kucharska et al. (2022). With technological progress reshaping industries, effectively managing tacit knowledge has become essential for organisational competitiveness, especially in heavy research sectors. The challenge intensifies in academic construction environments where experienced researchers possess significant yet often unarticulated knowledge. Recognising and utilising this expertise is crucial for sustaining innovation and guiding the sector's evolution. This paper investigates approaches to managing the tacit knowledge of long-term scientific seniority personnel, aiming to encourage practical discussions and collaborative research efforts within this specific context.

The subject was derived from the author's professional trajectory, stemming from her involvement at the Building Research Institute (ITB) since 2016. Two opposing mechanisms of tacit knowledge management have recently been identified within the ITB. The first pertains to the challenges of transferring knowledge from senior researchers, as impending retirement could precipitate a significant loss of experiential knowledge. The second, in contrast, illustrates the successful acquisition of tacit knowledge through interactive observation, a process the author has experienced first-hand during her collaboration with ITB's scientific secretary, Professor Lech Czarnecki, an outstanding specialist in the field of building materials engineering who has accumulated unique experience and skills during his over forty-year scientific career.

1.2 Key Definitions

The definitions of the key terms used in this study are described in detail. The management method "is a proven, recognised, logically structured way of solving specific organisational problems" (Morawski and Prudzienica, 2011). Tacit knowledge "is inextricably linked with a person, not easy to transfer and codify, it is a unique compilation of know-how, professional qualifications based on knowledge obtained in the process of formal education, skills (...), experiences, substantive observations, developed methods of conduct (...)." (Morawski 2017). An employee with long scientific seniority (LSS) obtained a PhD degree at least 25 years ago (approximately 1999 and earlier). Construction is characterised by a rather conservative and formal approach, which results 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..

1.3 Literature Review

1.3.1 Knowledge Management, Generations and Academia

A preliminary literature review was conducted to establish this research context. Sanei et al. (2013) delineated the process of knowledge transfer between generations T, BB, X, and Y in construction and engineering organisations headquartered in the United States. Brčić and Mihelič (2015) reported the results of research conducted in Slovakia on employees from the BB, X, and Y generations. This study examined how selected individual factors, including willingness, motivation, communication, and cooperation, influence the sharing of knowledge with colleagues. Virta's (2011) doctoral thesis analysed the transfer of knowledge between retiring employees and their successors in a medium-sized Finnish company that designs and produces electrical devices and systems for the global market.

In Poland, an article published in 2018 (Chomątowska, Żarczyńska-Dobiesz, 2018) explored the characteristics of the BB generation and presented the results of a study on the barriers to knowledge sharing among BB generation representatives. Responses were provided by representatives of both the organisation and the BB generation. Sidor-Rządkowska (2018) discussed the challenges of managing generational diversity in contemporary organisations and the benefits of implementing mentoring programs.

Dziadek (2019) presented a different perspective, which examined the problems and challenges associated with intergenerational knowledge transfer in modern enterprises across four generations: BB, X, Y, and Z. This study focused primarily on determining whether knowledge transfer systems were implemented in selected organisations and the ways in which these systems function, as well as understanding the intergenerational knowledge transfer model in businesses. Research conducted by Morawski (2017) appears to be closest to the doctoral student's area of interest, as it relates to the ability of key employees of the company to share knowledge (diffusion) and how employees with long scientific experience can be defined.

In recent publications, a study conducted by Chinese researchers (Rui and Ju, 2022) examined the application of relationship management theory in the transfer of knowledge between generations among younger employees aged 40 or less from various industries in China. Another article (Wang et al., 2023) discussed the relationship between workplace ostracism and knowledge-sharing behaviour in academia in China.

From the literature, four main research interests related to LSS have emerged:

- the diffusion/transfer of tacit knowledge of LSS employees,
- the way of managing this tacit knowledge,
- the management of generational diversity,
- identifying and overcoming barriers to knowledge sharing.

Together, these areas shape the research context on the tacit knowledge of LSS employees (Fig. 1).



Figure 1: Four main areas of the research context, [own elaboration]

1.3.2 Tacit Knowledge in Construction

Publications related to the construction field primarily focus on enhancing the productivity of organisations in the construction industry. It is essential to acknowledge that tacit knowledge plays a crucial role in the construction industry, as highlighted by Pathirage et al. (2007). In a subsequent article by the same authors (Pathirage et al., 2008), tacit knowledge in construction was defined 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 [...]". Research conducted on construction contractors in Hong Kong confirmed the more significant strategic role of tacit knowledge, as described by Chen and Sherif (2009). Khuzaimah and Hassan (2012) addressed the role of CoPs in knowledge management related to construction projects. Among more recent publications, Zhou et al. (2022) emphasised the process of externalisation of tacit knowledge in construction projects.

2. The Phd Thesis Framework

2.1 Scientific Gap

The noticed scientific gap refers to the primary process of sharing tacit knowledge (and more broadly, other processes) by LSS employees, that is, employees with long scientific seniority (min. 25 years after their doctorate, thanks to their unique life, professional, and scientific experience, they probably have unique tacit knowledge, which translates into their 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 that requires strict compliance with standards and rules and careful introduction of innovations and is characterised by formality and conservativeness. This is because the constructed structures must ensure the safety and durability of use. In this context, the tacit knowledge of construction scientists—a combination of experience, skills, and engineering intuition—is an important resource that can influence further development of scientific knowledge in the field of construction. The aforementioned formalism and caution may pose additional challenges to the diffusion of such important tacit knowledge.

2.2 Research Problem Definition

The primary aim of this study was to verify and develop methods to support the management of tacit knowledge of LSSs in construction institutions. Unlike tacit knowledge, explicit knowledge can be easily shared through scientific publications, databases, manuals, training materials, policies, and procedures, or the Internet and social media. Tacit knowledge, in the form of intuition, experience, skills, or reasoning, is not easy to capture, but is essential for retaining knowledge (in the context of staff turnover), strengthening cooperation between employees, improving efficiency and productivity, and fostering innovation. The main research question of this study is: "How should the tacit knowledge of LSSs be managed to preserve and pass their legacy onto younger generations?"

2.3 Research Methodology:

2.3.1 Research Methods

The doctoral project will utilise the following methods.

- Review and critiquing the literature
- Analysing documents (if applicable)
- Diagnostic surveys: Online questionnaires and in-depth interviews
- Expert Panel Discussion
- Heuristic techniques, such as brainstorming (if applicable, based on research outcomes and changes in the situation).

The expert panel offers valuable insights that are not accessible using other methods. Combining all these methods aims to provide a thorough, multi-sided view of the research topic, which will help develop a more customised method to encourage the spread of tacit knowledge among LSS employees.

2.3.2 Sample Selection

This research will be conducted across eight scientific institutions, split evenly between Poland and Europe. In Poland, the investigation will involve two research institutes and two construction faculties of polytechnics/universities. The same arrangement will apply to Europe-based institutions as well.

A purposive non-random sampling strategy ensures the most representative research results. The sample will include three study groups.

- LSS employees,
- Leaders of LSS employees,
- Individuals working with LSS employees (both academic and administrative staff).

Preliminary studies will be carried out at one Polish research institute, while other studies will be conducted across all eight institutions. The choice to concentrate on European countries rather than on Asian or American ones stems from their common cultural and historical contexts, which could affect tacit knowledge transfer methods.

2.3.3 Research Plan

In the first year, preparations for the research were conducted, including a literature review. Research assumptions in the academic environment of management sciences and construction were presented (participation in national and international conferences). The second year focuses on research, conducting a pilot and main survey as well as in-depth interviews, analysing all collected data, and developing a method to promote the spread of LSS employees' tacit knowledge. The third year is set aside for implementation, testing, and validation of the method. In the fourth year, the last year, it is planned to prepare conclusions and recommendations for academic institutions in the field of construction that employ LSS workers.

2.4 Expected New Contribution of the PhD Study

2.4.1 Theoretical Contribution

It is assumed that as a result of doctoral research, the following contributions will be made to the existing theoretical knowledge:

- Development of tacit knowledge management methods for different generations,
- Defining a group of LSS people, i.e. with long scientific experience, whose tacit knowledge is important for the development of construction,
- Identifying key challenges and barriers in managing tacit knowledge in construction due to significant generational differences,
- Identifying potential benefits from consciously managing the tacit knowledge of LSS employees.

2.4.2 Practical Contribution

The expected practical contributions to the research include the following:

- Developing a set of best practices and strategies for managing tacit knowledge, encouraging cooperation and knowledge sharing among different generations of researchers,
- Developing recommendations for changes in organisational structures, processes, and internal policies to better manage tacit knowledge in construction.

Subsequently, the insights obtained from this study could be applied and investigated further in diverse geographical contexts, including Asian, African, and American countries. Similarly, the methods and tools developed in this study could extend beyond construction to other disciplines and industries. Future research could explore how tacit knowledge is managed in various fields, such as the sciences, humanities, and social sciences, and how companies across different sectors manage and promote the diffusion of tacit knowledge across generations.

3. Methods

3.1 Methodology

3.1.1 Basic Information

This pilot study was the first element of a doctoral research programme. It was an online survey (three different forms) whose purpose was, among other things, to verify research tools and data collection methods. The main goals were to check how research workers in the field of construction would cope with a survey related to the tacit knowledge of employees with long scientific seniority (whether the questions are understandable and the scale of answers is appropriate, plus feedback and comments on the study), testing the research tool (MS Forms) in terms of providing answers, as well as their analysis and preliminary identification of survey areas requiring changes. MS Forms was used to conduct the survey and Microsoft Excel was used for the analysis. The choice of these tools is dictated by their availability and ease of use.

3.1.2 Sample

The pilot study was conducted at a Polish research institute specialising in construction; 22 individuals from all three groups took part. Participants were selected based on voluntary registration, meaning that those who met the conditions and expressed their willingness to participate after being informed about the purpose and scope of the study were invited.

3.1.3 Questionnaire

The study included 72 statements in five areas, with a space for comments after each area, and at the end, the so-called metrics for each group. These areas are:

- I. Statements regarding awareness of tacit knowledge (15 statements);
- II. Statements regarding personal motivation to share (or not) tacit knowledge (28 statements);
- III. Statements regarding traditional vs. approach innovative (12 statements);
- IV. Statements regarding organizational support for knowledge sharing (11 statements);
- V. Statements on managing generational diversity (six statements).

A separate MS form was prepared for each treatment group. The respondents were asked to rate the statements on a Likert scale (1-5), where 1 means "I strongly disagree" and 5 means "I strongly agree".

3.1.4 Data Analysis

Statistical analysis was conducted using MS Excel, which is the most easily available software. Mean values, medians, and standard deviations were calculated for each statement area across the entire sample group. Subsequently, the mean values for each area were computed for the three specific participant groups and compared to the overall results. This approach helped identify areas that required more attention in the main study. Additionally, technical changes were introduced into the structure of the main survey, and it was decided to change the tool for the main survey.

3.1.5 Influence on the Main Survey

As a result of the pilot survey, the following changes were made to the survey questionnaire:

- Context and more detailed descriptions of the statements were added to make it easier for respondents to answer.
- The number of statements increased to 94, especially in Areas II (+9), IV (+5), and I (+4).
- In the description of the rating scale, the value "3", previously described as "I have no opinion", was defined as "I have no opinion/both yes and no/I don't know", which gave greater freedom to express uncertainty.
- The part regarding the so-called "metrics" has been rearranged and unified to make it identical for all three survey forms.

In the main survey, to allow more time for responses and to allow them to be carefully considered, the questionnaires were sent as PDF files via e-mail before sending the survey link.

The response collection tool was changed to allow participants to save the survey while completing it, and to facilitate data analysis. The change was also dictated by an increase in the total number of questions in the questionnaire to over 100 (including the "metrics"), which exceeded the limit available for free in the MS Forms.

3.1.6 Limitations

Because the survey was conducted in one research institution, attention should be paid to the limitations of this study.

- limited representativeness of the research sample,
- the influence of the institutional context,
- limited objectivity of respondents.

The actual research group includes eight institutions, four from Poland and four from Europe, which will translate into a greater diversity of respondents and more reliable results.

3.2 Study Description

The preparations were performed prior to the pilot survey. On 23 November 2023, a meeting with the institute's employees was held, during which the concept of the doctoral dissertation was presented, key definitions and expected results were explained, and further steps regarding the research were taken. The assumptions of the survey, its objectives, and a discussion of the questionnaires, divided into areas, were presented and discussed. After the meeting, questions were sent to the participants who provided feedback. On this basis, some changes were made to the questionnaire.

The pilot study allowed for testing the survey questionnaire under practical conditions, with the participation of individuals representing the studied population. This enabled the collection of valuable feedback on the clarity and comprehensibility of the questions, as well as the overall structure of the research tool, contributing to the optimisation of the methodology before proceeding to the main stage of the study.

Links to the surveys were sent by e-mail and posted on the intranet, along with a cover letter and a short introduction to the topic. The survey form was active from 8 December 2023 to 3 January 2024. There were no restrictions on the time required to complete the survey, and anonymity was ensured using the appropriate MS Forms function. A total of 22 complete surveys were conducted. The groups were broken down as follows.

- Three LSS individuals
- Four individuals serving as LSS leaders, L-LSS
- 15 individuals cooperating with LSS, C-LSS

The main research will cover eight research institutions and will include:

- at least eight LSS individuals
- at least eight individuals serving as LSS leaders
- at least 16 individuals cooperating with LSS.

This means that the pilot sample constituted of (assuming minimums):

- LSS individuals: 37.5%
- LSS leaders: 50%
- Individuals cooperating: 94%

for the group planned for the main research.

4. Results

4.1 Research Sample Characteristics

The following is a summary of the data characterising the research sample. Given that respondents volunteered to participate, the distribution was

Table 1: Division by gender

Gender	Number	Share
Women	11	50%
Men	11	50%

Table 2: Division by generation, according to Sidor-Rządkowska, 2018

Generation	Number	Share
Generation T	2	9%
Generation BB	2	9%
Generation X	11	50%
Generation Y	7	32%

Table 3: Division according to the type of work performed

Type of work	Number	Share
Academic Staff	11	50%
Administrative Staff	11	50%

Table 4: Degree/title of academic staff

Degree/Title of Academic Staff	Number	Share
Professor	2	18%
Doctor with habilitation	2	18%
PhD	7	64%

Table 5: Education level of administrative staff

Level of Education	Number	Share
PhD	2	18%
Eng/Bachelors	2	18%
Masters	7	64%

Using a 5-point Likert scale in the study enabled the determination of the respondent's level of agreement with the presented statements. A low level occurs when the average value (the arithmetic mean calculated from all responses) is equal to or less than 2.99, moderate when the average falls in the range of 3–3.99, and high when the average is equal to 4 or greater than 4 (Sekaran & Bougie, 2016, as cited in Piwowski-Sulej, 2022).

Upon examining the average values for the five statement areas presented in Table 6, it is noted that only two statements registered averages below 2.99, signifying a low level of concordance among respondents. The remaining three statement areas exhibited average values that fell within the range of 3 to 3.99, reflecting a moderate degree of agreement. Table 7 shows the average response scores for each group relative to the overall mean. This delineation distinctly reveals a high level of agreement in the first area between LSS individuals and their coworkers. Conversely, the second and fourth areas showed low agreement between the LSS and C-LSS groups. The third area maintains a moderate level of statement agreement, whereas the fifth area shows high concordance among leaders and moderate agreement within the cohorts of the LSS and their co-workers.

Table 6: Statistical data for five survey areas, results for the entire research sample

Area	Average	Median	Standard Deviation
I. Statements regarding the awareness of tacit knowledge	3.9	4	1.04
II. Statements regarding personal motivation to share (or not) tacit knowledge	2.96	3	1.25
III. Statements regarding traditional vs. innovative approach	3.67	4	0.93
IV. Statements regarding organizational support for knowledge sharing	2.94	3	1.12
V. Statements regarding the management of generational diversity	3.6	4	1.08

Table 7: Statistical data – average – for five survey areas, results for each group

Area	Average LSS	Average L-LSS	Average C-LSS	Average
I. Statements regarding the awareness of tacit knowledge	4.16	3.35	4.0	3.9
II. Statements regarding personal motivation to share (or not) tacit knowledge	2.87	3.14	2.93	2.96
III. Statements regarding traditional vs. innovative approach	3.78	3.31	3.74	3.67
IV. Statements regarding organizational support for knowledge sharing	2.91	3.05	2.92	2.94
V. Statements regarding the management of generational diversity	3.50	4.04	3.50	3.6

To further explore the statements showing the most significant discrepancy, the following is an analysis of all five areas, detailing the responses from each group. In the first area, respondents agreed that the experience of LSS is valuable and unique. There is some disagreement between the L-LSS and other groups regarding the support offered by the LSS. However, the most significant discrepancy occurs in the statement regarding statement 9: "The knowledge of an LSS person is too specific to be transferred in a simple way, so the ability to observe and imitate his actions is important." People with LSS disagree with this opinion, while the other two groups agree.

Within the second statement area, consensus was evident across all groups for the nine statements. Notable divergence was observed between the L-LSS and the other two groups on the nine statements. A similar pattern of low agreement was noted between C-LSS and the other groups for two statements and across all groups for five statements.

In the third area, relating to the application of innovations and traditions in construction, respondents also agreed highly with seven statements. Some discrepancies appeared in tradition-related statements (three). However, the most significant disagreement concerns two statements. Both LSS and C-LSS agree that new trends in science are often overrated (L-LSS disagrees on this matter). Regarding the statement about "sticking to traditional approaches in construction because they have been tested by time", this area has the most significant disagreement. LSS individuals agree on this matter, L-LSSs disagree, and C-LSSs do not have clear opinions.

In the fourth area, all groups consistently agreed on three statements. Lower levels of agreement were found between the L-LSS and the others on two statements and between the C-LSS and the others on two statements. Finally, four statements demonstrated low agreement among all the groups.

In the fifth area (Fig. 5), there is general agreement on the three statements. In the case of the two statements, LSS and L-LSS agree, and C-LSSs do not have a common opinion. As for one statement, only the L-LSSs agree; the remaining groups do not have a clear opinion.

5. Discussion

5.1 Summary of Main Findings

This pilot survey yielded several important conclusions regarding the management of tacit knowledge among employees with long scientific seniority (LSS) at a construction institution. This study identified key areas in which tacit knowledge sharing is both robust and insufficient. In particular, the areas of personal motivation to share tacit knowledge and organisational support for knowledge sharing showed the lowest means and medians, indicating the need for further study. The results of the pilot survey suggest significant divergence in perceptions and motivations among LSS employees, their leaders, and co-workers. Notably, LSS employees appear to

undervalue the specificity and importance of their tacit knowledge, which may hinder effective knowledge transfer. This will be further examined in the main study.

5.2 Addressing Goals of the Pilot Study

The pilot study aimed to verify the research tools and data collection methods with specific goals:

- Assess understandability and appropriateness of questions: The pilot study successfully identified areas where the questions were unclear, or the scale of answers was inappropriate. This feedback led to adjustments in the survey design, improved clarity and ensured that the questions accurately captured the intended information.
- Test the research tool (MS Forms): The use of MS Forms was evaluated for its effectiveness in collecting and analysing data. While the tool was generally user-friendly, the pilot study revealed the need for a more sophisticated platform for the main survey, prompting a switch to a tool that allows saving progress and facilitates easier data analysis.
- Identify survey areas requiring changes: Preliminary analysis of the pilot data highlights specific areas requiring modification. For instance, an additional context was added to statements, the number of questions was increased to cover gaps identified during the pilot, and the rating scale was refined to better capture respondents' opinions.

By addressing these goals, the pilot study provided valuable insights that informed the refinement of the research methodology, ensuring that the main survey was more robust and capable of capturing comprehensive data on the management of tacit knowledge among LSS employees.

6. Conclusions

Here, represents the sum of the main conclusions.

- LSS employees do not realise that their knowledge and experience are unique and sufficiently specific to require appropriate diffusion methods.
- There is a need for greater support for organisations to share knowledge in material and organizational areas (including organizational culture).
- The role of a mentor should be formally embedded in the organisation, especially in the case of LSS people with high authority.
- Supporting interdepartmental and team initiatives with a diverse generational profile may result in greater efficiency in such teams' work and strengthen relationships and understanding between different groups of employees.

The pilot survey results shed light on LSS people's motivations for sharing tacit knowledge. In several cases, there were apparent differences between the perceptions of LSS individuals and the reception of these people by their leaders and colleagues. There are differences in the perception of the role and value of tacit knowledge among LSS, L-LSS, and C-LSS, especially in terms of effectiveness, motivation, and organizational support. All groups agreed on the need to balance tradition and innovation and the importance of mentoring and collaboration for scientific development. The development of organizational tools and strategies to support the diffusion of tacit knowledge is necessary. This indicates the need to better understand and implement modern communication tools and knowledge management methods to respond to different generational needs. Increasing awareness and appreciation of tacit knowledge at all organizational levels is necessary to maximise its potential for innovation and institutional development.

These results will be verified by an actual survey in which representatives of 16 scientific units from Poland and Europe will participate.

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