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THE STRATEGY OF KNOWLEDGE TRANSFER IN THE REHABILITATION PROJECT OF IMMANUEL CHURCH (BLEDUK), SEMARANG CITY

Ruliana Febrianty¹, Mochamad Agung Wibowo², Jati Utomo Dwi Hatmoko³

^{1,2,3}Departement of Civil Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang, 50271, Indonesia.

*Corresponding author: rullyanafebrianti@yahoo.com

ABSTRACT

The knowledge transfer plays a vital role in maintaining the quality of construction projects, especially in the rehabilitation of heritage buildings, which demand a contextual expertise and a deep understanding of historical values. **Aims:** This study aims to explore and analyze the implementation of knowledge transfer strategies by construction companies in the historical building conservation projects. **Methodology and results:** Employing a qualitative approach, data were collected through in-depth interviews, field observations, and document analysis of selected rehabilitation projects. The findings indicate that knowledge transfer in such projects is predominantly informal and relies on individual experience, interpersonal networks, and intergenerational communication. Tacit knowledge, including traditional conservation techniques and assessment of aged materials, remains undocumented and is not incorporated into formal knowledge management systems. **Conclusion, significant, and impact of study:** The identification of effective strategies includes experience-based mentorship, cross-generational collaboration, team-incentives, and documented digital-tools. The study recommends the development of adaptive and participatory knowledge management systems to enhance the sustainability of conservation practices and preserve historical values across generations.

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1. INTRODUCTION

In heritage building rehabilitation projects, knowledge is not solely derived from technical documents or conservation guidelines. Rather, it relies heavily on the practical experience of workers, professional intuition, and an understanding of historical context and traditional construction techniques [1]. This knowledge is often tacit because it is acquired through direct involvement in restoration activities, the selection of traditional materials, and the interpretation of building conditions that are not explicitly outlined in standard drawings or technical specifications [2]. The success of these projects largely depends on the ability of skilled workers and experts to adapt technical approaches to the unique characteristics of each heritage structure. However, the documentation of such experiential knowledge remains highly limited [3] [4]. Consequently, valuable lessons learned from these projects often remain undocumented and cannot be effectively transferred to future projects.

In the construction industry, knowledge is acquired not only from formal documents and technical guidelines but also from workers' experience, professional intuition, and field practices that are not always systematically documented [5] [6]. This type of knowledge is generally tacit and embedded within individuals. It is difficult to transfer without direct interaction or shared experience [7]. In construction projects, tacit knowledge is a valuable asset for construction companies [8], yet it is vulnerable to loss if not properly managed [9]. These conditions disrupt the organizational learning cycle [10] [11], leading to the potential loss of critical knowledge when projects are completed or key personnel are relocated.

Heritage buildings are more than just physical representations of the past. They also embody social and architectural values that must be preserved sustainably [1]. However, conserving and rehabilitating these buildings presents significant technical and managerial challenges, particularly because these processes must integrate preservation principles with modern construction approaches. The knowledge required for heritage building rehabilitation projects is generally tacit and is acquired through direct experience, field observation, and interaction among workers across generations. This knowledge is difficult to transfer through formal documents or technical guidelines [7]. In Indonesia, most knowledge transfer processes are still informal, relying on social networks and daily work practices [12]. Consequently, valuable knowledge is often lost when a project is completed or workers transfer to other assignments.

Previous studies have extensively discussed the importance of knowledge management systems in the construction sector [13] [6]. However, literature that specifically examines knowledge transfer in heritage building rehabilitation projects, particularly in developing

countries, remains limited. Most research has focused more on technical aspects of conservation or material preservation, while the social dimensions, organizational culture, and strategies for knowledge sharing among project stakeholders have been relatively underexplored (Della Torre et al., 2019). This limitation indicates that the existing body of literature has not fully captured the novelty and complexity of collective learning processes. Based on this background, the research problem addressed in this study is: How are the knowledge transfer strategies implemented in the rehabilitation project of Immanuel Church (Bleduk) in Semarang City?

This study aims to identify and describe the knowledge transfer strategies used in heritage rehabilitation projects. The study also aims to provide strategic recommendations for developing effective knowledge management systems. The research is significant because it contributes to the advancement of knowledge management theory in the context of rehabilitation projects. Furthermore, construction companies, local governments, and heritage preservation agencies can use the study's findings to design training programs, documentation practices, and collaborative systems that support the sustainable preservation of conservation knowledge.

This study uses a qualitative approach with an exploratory case study strategy. Data were collected through in-depth interviews with construction professionals experienced in rehabilitation projects, as well as through field observations and analysis of project documents. The data were analyzed thematically to identify patterns, themes, and knowledge transfer strategies that emerged from actual field practices. It is also assumed that project-specific strategies such as experience-based mentorship, cross-cultural training, technology-based documentation, and open evaluation can strengthen the knowledge transfer process in rehabilitation projects. Therefore, this study posits that even though formal systems have not yet been fully developed, adaptive and project-based knowledge transfer practices can be optimized to improve knowledge sustainability.

Although the issue of knowledge transfer has received considerable attention in construction management studies, most existing research remains focused on developing information technology and knowledge database systems, as well as quantitative approaches. There is limited emphasis on actually implementing knowledge transfer in heritage building rehabilitation projects. Furthermore, literature on rehabilitation projects in developing countries such as Indonesia tends to describe technical aspects or preservation policies but rarely explores how tacit knowledge is transferred on-site. This study's qualitative approach is novel because it identifies and analyzes knowledge transfer strategies based on direct experiential practices. This study is important because it addresses the existing gap by employing a qualitative approach that

enables an in-depth exploration of the factors that support knowledge transfer strategies under real-world conditions.

2. RESEARCH METHODOLOGY

This study adopts a qualitative approach to explore the implementation of in-depth knowledge transfer strategies within construction companies. The detailed design process is presented below.

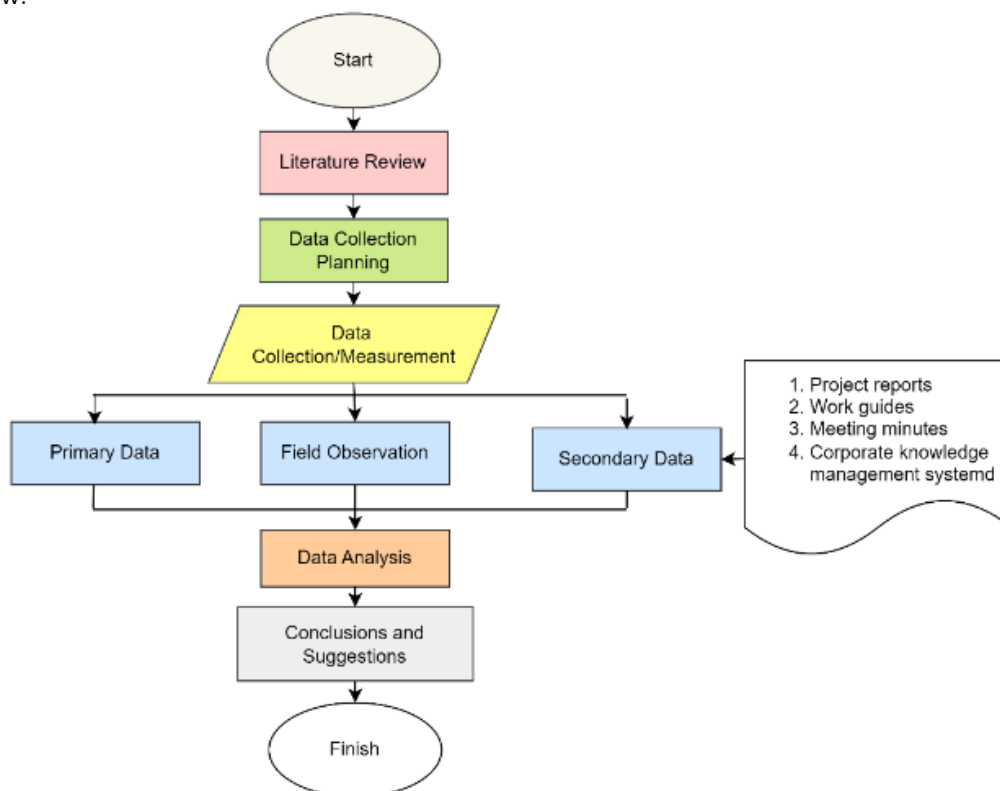


Fig. 1 Research flowchart

This research employs a qualitative approach with an exploratory case study strategy because the study focuses on gaining an in-depth understanding of the practices and knowledge transfer strategies within the complex, contextual environment of heritage building rehabilitation projects. This approach was chosen because it allows for the exploration of social dynamics, tacit knowledge, and informal processes that cannot be accurately measured by quantitative methods.

2.1 Research Location and Object

The research focuses on a construction company representing the private sector with a medium-level qualification classification. The company was selected for its involvement in the rehabilitation project of Immanuel Church (Bleduk) in Semarang City.

Table 1: Characteristics of research informants

Key Informan	Position	Pengalaman Kerja (Tahun)	Construction Company Qualification
Construction Company YY	Director	16	M

The primary informants in this study were professionals directly involved in the conservation project. One key informant had over 16 years of experience working in the construction field, particularly on heritage building rehabilitation projects. This extensive experience ensures that the narratives and perspectives provided reflect actual practices and learning accumulated from various similar projects.

This study focuses on a heritage building rehabilitation project that took place over 180 calendar days. This ensures that the collected data is relatively up-to-date and relevant to the latest developments in conservation policies and approaches in Indonesia. The project was purposefully selected based on the following criteria:

1. The presence of challenges in preserving the building's historical value within modern construction practices.
2. The involvement of multiple actors across generations and disciplines.
3. The existence of documentation or knowledge transfer practices during the implementation process of the project.

2.2 Data Collection Techniques

The data collection technique involved conducting in-depth, semi-structured interviews. These interviews were conducted face-to-face with key informants. Field observations were carried out to directly observe work processes, team interactions, and information-sharing mechanisms within the project environment. Document analysis was conducted on internal documents, including project reports, work guidelines, meeting minutes, and the company's knowledge management system.

2.3 Data Analysis Techniques

The data were analyzed using thematic analysis with an open, axial, and selective coding approaches, following established procedures. The analysis process involved several stages, transcribing interview and observation results; identifying key themes emerging from the data, and interpreting relationships between themes to address the research questions.

2.4 Data Validity

To ensure the credibility of the sources, a triangulation method was employed, which involved

comparing the results of interviews, observations, and document analysis [14]. In addition, member checking was carried out with informants to validate the accuracy of the data interpretation.

3. RESULTS AND DISCUSSION

This study identified six main themes related to knowledge transfer strategies in the rehabilitation project. These themes are: high project complexity; challenges and risks concerning occupational health and safety; high complexity combined with limited project duration; project location in a city center; strict regulations governing heritage buildings; and specific technical characteristics unique to conservation construction projects. These themes were derived through a thematic analysis of data collected from interviews, field observations, and internal project documentation.

3.1 High Complexity

Construction projects are highly complex and often involve diverse working approaches [15] [16].

Knowledge transfer strategies are illustrated in fig.2.

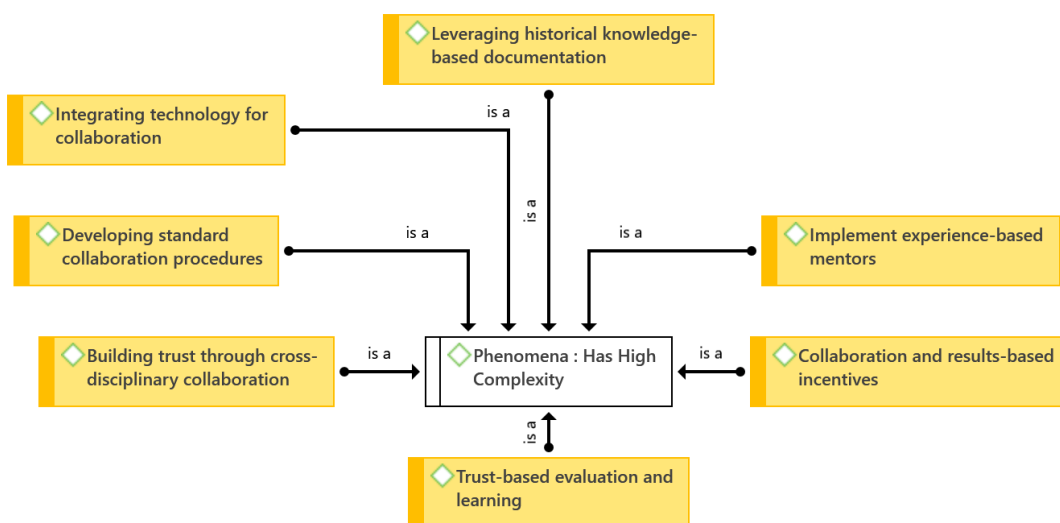


Fig. 2 Knowledge transfer strategy for the first phenomenon

Effective knowledge transfer strategies in construction projects are closely linked to building trust through interdisciplinary collaboration [17]. Trust arises from demonstrated competence, integrity, and goodwill, all of which are developed through sustained cross-disciplinary collaboration [18].

Converting tacit knowledge into explicit forms through knowledge-based documentation ensures that information is accessible to all stakeholders [7]. Without proper documentation strategies, this knowledge is at high risk of being lost once the project is completed or when key personnel leave.

Experience-based mentoring, which involves leveraging informal relationships within social networks to enhance knowledge transfer, is a key strategy [19]. In this approach, senior workers (mentors) actively guide junior workers through direct interactions, both on-site and in informal settings.

Another key strategy is integrating technology to support collaboration, where technological systems play a central role in enabling effective knowledge sharing [20]. Incorporating technology into collaborative processes accelerates the flow of information and serves as a critical foundation for organizational transformation toward continuous learning and knowledge management.

Standardized collaboration procedures are essential for aligning diverse work cultures. Developing standardized collaboration protocols is essential for fostering efficient synergy within heterogeneous project environments [21].

Incentives can motivate knowledge-sharing behavior [22]. Team-based incentives serve as motivational tools and strategic mechanisms for fostering a collaborative, learning-oriented organizational culture.

Experience-based learning strengthens knowledge transfer in complex environments [23]. Trust-based evaluation and learning are key approaches to enhancing knowledge transfer in complex project environments.

3.2 Challenges of Work Risks and Safety

Construction projects face challenges related to risk and occupational safety that significantly impact the workforce [24]. The knowledge transfer strategy is presented in Fig.3.

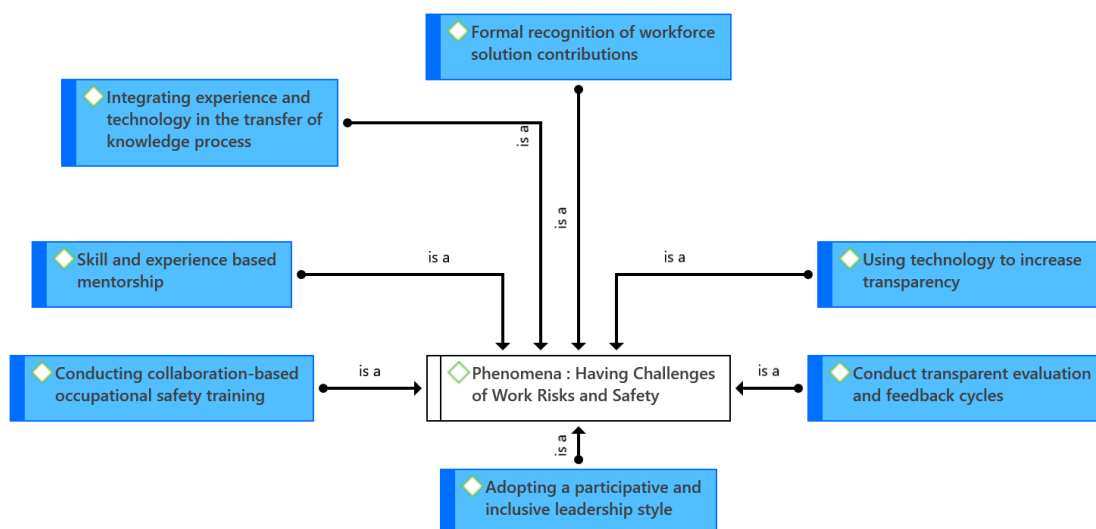


Fig 3. Knowledge transfer strategy for the second phenomenon

Effective knowledge transfer strategies involve adopting participative and inclusive

leadership styles. Transformational leadership, for example, has been shown to enhance collaboration and trust [25]. Recognizing experience-based solutions contributed by workers is crucial for fostering interpersonal trust [26]. This approach makes knowledge transfer to become more dynamic and widely distributed, enhancing competitiveness.

Integrating experience and technology into the knowledge transfer process is a fundamental strategy for building adaptive, innovative, and highly competitive project-based organizations [7]. Workers' experience should not remain confined to the field. Instead, it must be transformed into explicit knowledge that can be stored, accessed, and reused.

Using technology to enhance transparency is a key strategy. Information systems are recognized as drivers of transparency [20]. With appropriate information systems, processes, decisions, and knowledge are no longer the exclusive domain of specific individuals, but rather, can be accessed, reviewed, and learned by all relevant stakeholders.

An approach combining experience-based mentoring with modern expertise is essential. Mentoring fosters adaptive learning and strengthens working relationships [27]. Transparent evaluation ensures that every solution to risks and occupational safety issues is acknowledged and addressed. Experience-based learning accelerates adaptation to project challenges [28]. Transparent safety evaluations are not only a moral and legal obligation, but also a crucial strategy for building sustainable, risk-adaptive project organizations.

Conducting joint training involving the entire workforce, including cross-cultural training to align different working approaches, is essential [29]. Amid the complexity of the project environment and the diversity of teams, training is essential for harmonizing work approaches building.

3.3 Having High Complexity and Limited Project Duration

Construction projects are characterized by their complexity and limited duration [30]. An effective knowledge transfer strategy is illustrated in Fig.4.

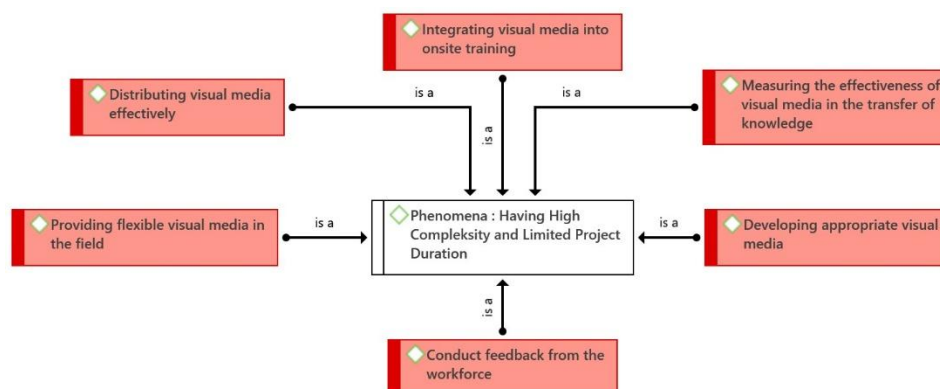


Fig. 4 Knowledge transfer strategy for the third phenomenon

Effective knowledge transfer strategies emphasize the importance of visual documentation for supporting the transfer of both tacit and explicit knowledge by developing appropriate visual media [31]. Selecting the appropriate medium for knowledge transfer is critically important [32].

Distributing visual media effectively is crucial because knowledge management systems (KMS) enhance accessibility to information and support knowledge transfer within large organizations [20]. Providing flexible visual media for field use ensures that knowledge can be accessed under various site conditions [33]. Integrating visual media into on-site training allows for direct interaction with visual guides, accelerating knowledge transfer [19]. Measuring the effectiveness of visual media in knowledge transfer underscores the importance of evaluation in enhancing learning outcomes and disseminating knowledge [30]. Gathering feedback from workers demonstrates that their active participation increases engagement in the learning process [20].

3.4 The Construction Project is Situated in the Heart of the City

The location of the construction project in the city center influences the level of trust among workers, thereby strengthening relationships between personnel. The knowledge transfer strategy is illustrated in fig.5.

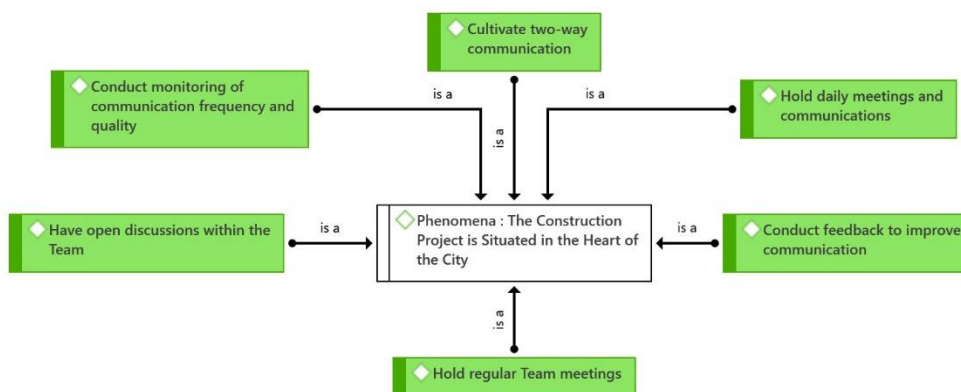


Fig. 5 Knowledge transfer strategy for the fourth phenomenon

Effective knowledge transfer strategies include holding regular team meetings because routine communication enhances openness and trust within teams [34][35]. Conducting daily meetings and facilitating on-site communication supports direct learning, fostering mutual understanding and trust among workers [36] [37]. Developing two-way communication demonstrates that feedback contributes to sustainable organizational learning [38]. Encouraging open discussions within teams shows that these practices enhance the transfer of both tacit and explicit knowledge [39]. Monitoring the frequency and quality of communication improves its effectiveness in supporting knowledge transfer [40] [41]. Collecting feedback to improve

communication shows that active user participation supports developing more effective communication systems [42].

3.5 Strict Regulations Regarding Cultural Heritage Buildings

Strict regulations in construction projects significantly influence implementation methods, making open and transparent leadership crucial for fostering trust among workers [43]. The knowledge transfer strategy is illustrated in the following figure.

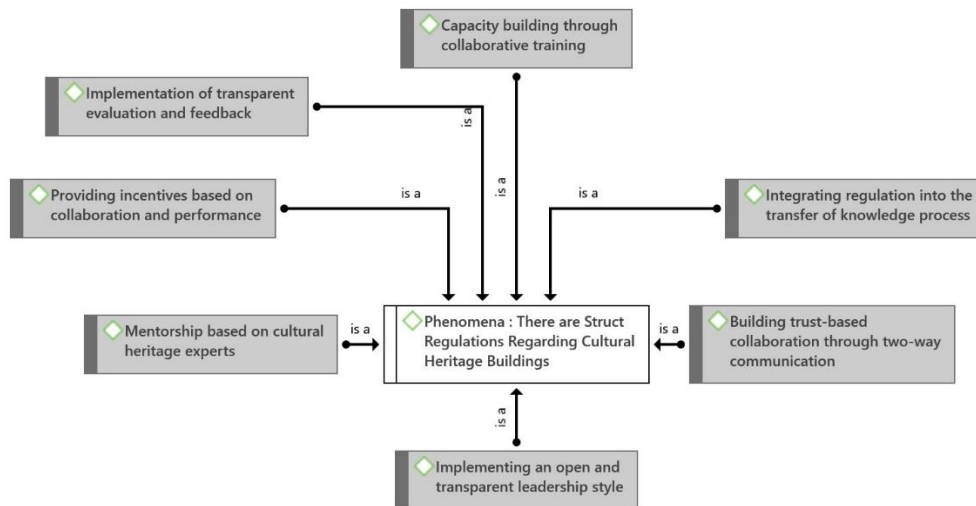


Fig. 6 Knowledge transfer strategy for the fifth phenomenon

Effective knowledge transfer strategies involve adopting leadership styles that emphasize openness and transparency. Transformational leadership grounded in transparency has been shown to enhance team engagement [44]. Integrating regulations into the knowledge transfer process ensures that explicit knowledge, such as legal and procedural standards, is embedded within the collaborative system [45]. Trust-based collaboration is built through two-way communication, as trust is established through consistent and open communication [18]. Mentorship approaches help ensure that implementation methods align with regulatory requirements and cultural values. Adaptive learning through mentoring is highly beneficial for navigating regulatory complexities [46]. Capacity building through collaborative training further accelerates knowledge transfer [20]. Implementing transparent evaluation and feedback mechanisms supports experience-based learning and facilitates adaptation to project challenges [28]. Finally, collaboration and performance-based incentives motivate knowledge-sharing behavior within project teams [47] [48].

3.6 Special Technical Characteristics of Construction Projects

Construction companies must comply with specific regulations and standards that influence the communication media necessary for long-term storage and accessibility.

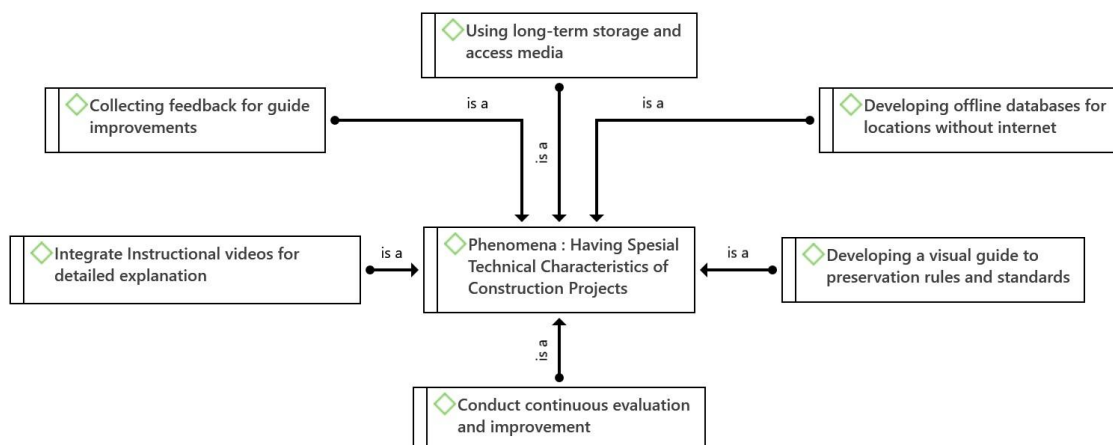


Fig. 7. Knowledge transfer strategy for the sixth phenomenon

The knowledge transfer process requires visual guidelines to explain preservation rules and standards. Effective knowledge transfer strategies involve developing visual guides for these regulations because visual media has been proven to support experience-based learning and significantly enhance technical understanding [28]. Integrating instructional videos that provide detailed explanations is also important because video media effectively facilitates the transfer of tacit knowledge [7]. Using long-term storage and access media emphasizes the role of knowledge management systems (KMS) in ensuring the retention of durable information and broad accessibility [20]. Offline databases developed for locations without internet connectivity demonstrate that flexible digital media can support knowledge transfer in challenging work environments [33]. Continuous evaluation and improvement processes are crucial because they contribute to organizational learning and effective knowledge transfer [19]. Collecting feedback to improve visual guidelines demonstrates that active workforce participation enhances learning effectiveness [49] [50].

The findings of this study significantly advance knowledge in the field of knowledge management, particularly in heritage building rehabilitation projects in developing countries. Using a qualitative approach, this study reveals that knowledge transfer strategies in heritage rehabilitation projects do not rely solely on formal systems. Rather, they emerge contextually through social practices rooted in experience, trust, and cross-generational collaboration. These findings expand the theoretical framework of knowledge management, which has traditionally been developed for highly technocratic, fully digitized industrial sectors. The study also emphasizes the importance of informal elements, such as mentorship, non-hierarchical communication, and reflective evaluation, as key mechanisms for preserving conservation knowledge that cannot be captured by conventional technical documentation systems.

Thus, this study provides a theoretical contribution to knowledge management literature

on rehabilitation projects and offers practical implications that field professionals and policymakers can adopt to strengthen the sustainable preservation of knowledge in the heritage construction sector.

4. CONCLUSION

This study's findings identify key strategies employed by construction companies to sustain knowledge. These strategies include experience-based mentorship, visual documentation and digitalization of information, cross-generational and cross-cultural collaboration, cross-cultural training, utilization of simple collaboration technologies, and reflective evaluation, as well as formal recognition of field workers' contributions. The study recommends strengthening experience-based documentation systems, formally recognizing field contributions, and integrating collaborative technologies as critical steps toward establishing a more contextual and sustainable knowledge management system in heritage building rehabilitation projects.

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6. AUTHOR CONTRIBUTION

RF contributed to the following: proposing ideas, performing formal analysis, writing, reviewing, and editing the original draft. MAW contributed to conceptualization, writing, supervising methods, and manuscript checking. JUDH contributed to the conceptualization, methodology, and validation of the study, as well as manuscript checking. All authors read and approved the final manuscript.

7. CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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