

## ONBOARDING AS KNOWLEDGE MANAGEMENT IN REMOTE SOFTWARE TEAMS: A LITERATURE REVIEW

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### ABSTRACT

This structured literature review examines software developer onboarding as a knowledge management (KM) process in remote, distributed, hybrid, and OSS teams. The set of 15 primary studies (2019-2025) synthesizes socio-technical practices aimed at accelerating the inclusion of new employees. The most common are case studies and mixed methods. Papers are mainly conference papers, with an increase in papers in journals. Outcome indicators are rarely and unevenly defined, so cross-study comparisons are limited. The onboarding process can be seen as an integration of explicit and tacit knowledge, and recommendations for practices can be derived from it, as well as guidelines for further research.

**Key words:** Onboarding, Knowledge Management, Software Engineering, Remote Teams, Literature Review.

### INTRODUCTION

Remote working conditions, as well as the hybrid mode of work, have reduced ambient learning and spontaneous knowledge exchange, which makes it much more difficult for new employees in software teams to access contexts, coordination and feedback, which is confirmed by surveys conducted during the COVID-19 pandemic (Ford et al., 2021). Since software engineering (SE) is a highly knowledge-intensive field, a successful onboarding process requires careful planning and balancing of explicit knowledge through internal artifacts, documentation, and tacit knowledge (practices, communities, etc.). This is also indicated by the systematic review KM in SE, emphasizing that the balance is often lost when the focus is solely on documentation (Bjørnson & Dingsøyr, 2008).

In organizational psychology, onboarding is often viewed as a process related to organizational socialization during which a new employee acquires new skills, knowledge, and behaviors necessary to successfully perform a job (Bauer & Erdogan, 2011). Meta-analyses of social tactics confirm a stable connection when it comes to the adaptation of new employees, where faster work performance is achieved, greater job satisfaction and thus the probability of leaving the current job is reduced (Saks et al., 2007).

In software engineering, a multi-case study of globally distributed projects identifies onboarding process challenges such as access to code and software tools, mentoring support, and team integration and highlights practices that facilitate them (Britto et al., 2018). Survey-model work links the success of the onboarding process with fit in the organization and the intention to leave of professional developers (Sharma & Stol, 2020). Lessons learned from Open-Source Software (OSS) communities

offer lessons such as systematic reviews of barriers to new hires that highlight documentation issues, finding initial tasks, and building social connections (Steinmacher et al., 2015), while empirical work around the Good First Issue (GFI) label shows that starting points facilitate entry into the process (Alderliesten & Zaidman, 2021). More recent work also presents automated recommendations of such tasks, which accelerates the involvement of new employees in real projects (Xiao et al., 2022). These lessons, together with the challenges faced by employees in the company, as well as the measures taken in remote projects (Britto et al., 2020, Rodeghero et al., 2021), provide a framework for observing the onboarding process as a knowledge management mechanism in distributed software teams.

## **RELATED WORK**

Previous reviews show that knowledge management in software engineering has often emphasized explicit knowledge, storage, and retrieval mechanisms, while tacit knowledge, learning, and knowledge transfer have received less systematic attention (Bjørnson & Dingsøyr, 2008). This distinction is important for onboarding because newcomers need both accessible artifacts and access to team routines, mentoring, contextual knowledge, and informal coordination mechanisms.

In distributed and agile software development, knowledge sharing is additionally affected by time-zone differences, cultural distance, tool mediation, and reduced face-to-face interaction (Zahedi et al., 2016, Yanzer Cabral et al., 2014). Prior work on social tools in software development also shows that collaborative platforms can support knowledge discovery and transfer, although their integration into everyday development work remains insufficiently explored (Sarka & Ipsen, 2017).

## **METHODOLOGY**

In this research paper, a structured literature review was conducted with a focus on onboarding as KM in remote, distributed, hybrid or OSS software teams. The goal of the research is to identify and map primary studies that explicitly deal with the topic of onboarding and KM practice (e.g. Documentation, handbook, mentoring, buddy program, Community of Practice). Certain literature review procedures were used in this research from (Kitchenham et al., 2009). Although this research does not represent a comprehensive systematic literature review, certain methodologies are presented in chapter 22 of the book (Kitchenham et al., 2009) and were applied as guidelines in the literature review process, which is also visually represented in Figure 1. Yellow blocks indicate the main stages of the review process, while gray blocks provide supplementary information about data sources, database-specific counts, and excluded records. For the consistency of the search of scientific papers, four main conceptual groups and their synonyms were selected, which were combined with the Boolean operators AND and OR and applied in the search fields:

- Keyword 1 (KW1) – “Onboarding”
- Keyword 2 (KW2) – “Software” OR “Developer”
- Keyword 3 (KW3) – “Remote” OR “Virtual” OR “Distributed” OR “Hybrid” OR “OSS”
- Keyword 4 (KW4) – “Knowledge Management” OR “Documentation” OR “Mentoring”

These four primary keywords represent basic terms that guide the search for relevant literature sources. Combining these four keywords forms the following search string:

KW1 AND KW2 AND KW3 AND KW4

This literature search string was applied across databases covering software engineering and computer science such as Springer, IEEE Xplore, Elsevier (ScienceDirect), Wiley, ACM Digital Library and Google Scholar. In this way, the risk of missing relevant papers due to differences in indexing between the selected databases was reduced:

- The papers for this Literature Review were selected based on specific inclusion criteria: (I1) Works published in the period from 2019-2025; (I2) Domain Software Engineering; (I3) Explicit link between Onboarding and Knowledge Management; (I4) Context Remote, Virtual,

Distributed, Hybrid or OSS; (I5) Peer-reviewed journal or full conference paper; (I6) Published in English language

- In order to ensure the relevance and quality of the selected literature sources for this Literature Review, certain exclusion criteria were applied: (E1) Non-peer-reviewed papers; (E2) Duplicates; (E3) Full-text unavailable; (E4) Outside the scope of Software Engineering or Onboarding (E5) Papers not published in English

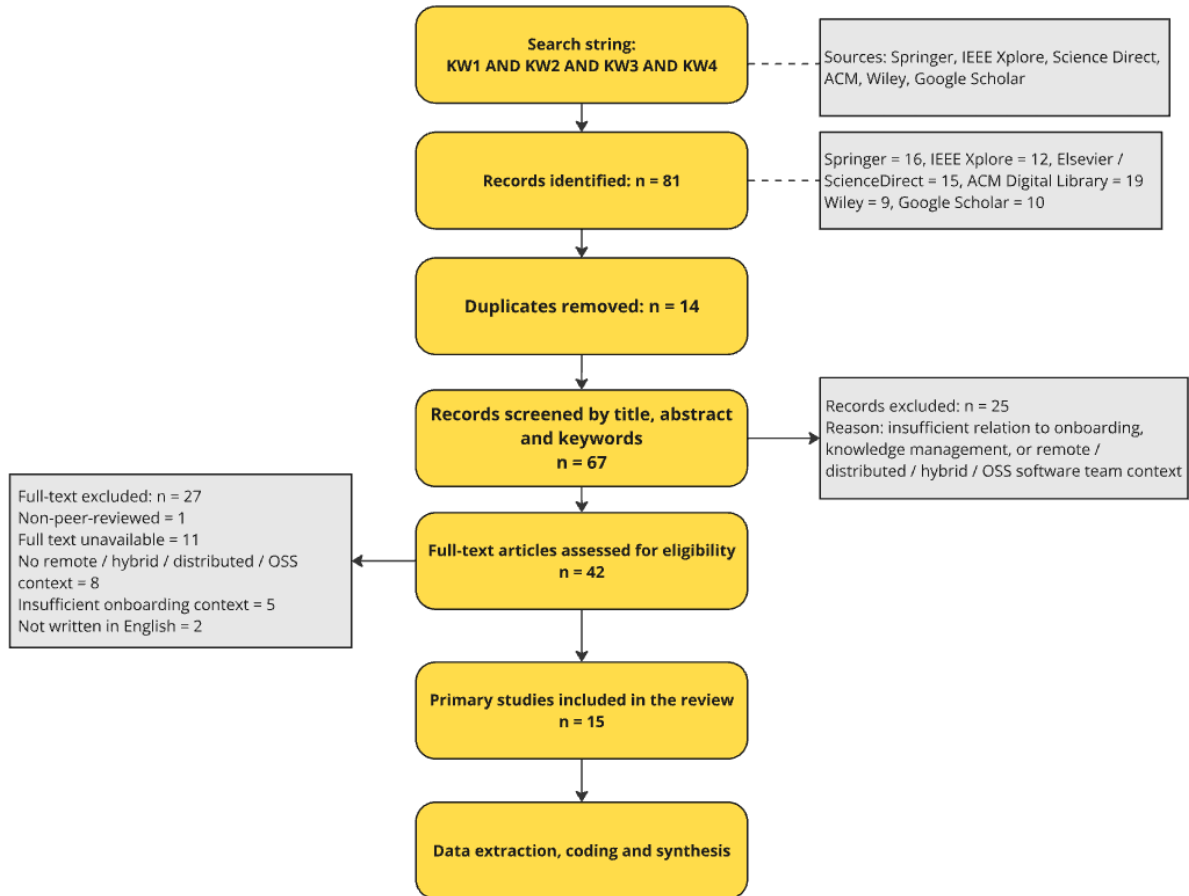


Figure 1: Figure 1: Flow of the structured literature review process

The application of the described procedures resulted in the following flow: 81 papers were identified from six sources for the period from 2019-2025. From Springer 16 papers, from IEEE Xplore 12 papers, Elsevier 15 papers, ACM 19 papers, Wiley 9 papers and Google Scholar 10 papers. By removing 14 duplicates (E2), 67 papers remained that had to go through the screening process for title, abstract and keyword. At this stage, 25 papers were excluded due to the insufficient context of onboarding and knowledge management in the context of remote work (E4), and 42 papers went into the process of detailed analysis of the entire text.

After reading the entire text, 1 paper was additionally excluded because it was not peer reviewed (E1), 11 papers due to insufficient access (E3), 8 papers did not contain a remote, hybrid or OSS context (E4), 5 papers did not contain a good onboarding context (E4), 2 papers were not in English (E5). Based on the full analysis, 15 papers were selected as primary studies (PS) that met all criteria and are listed in Table 1.

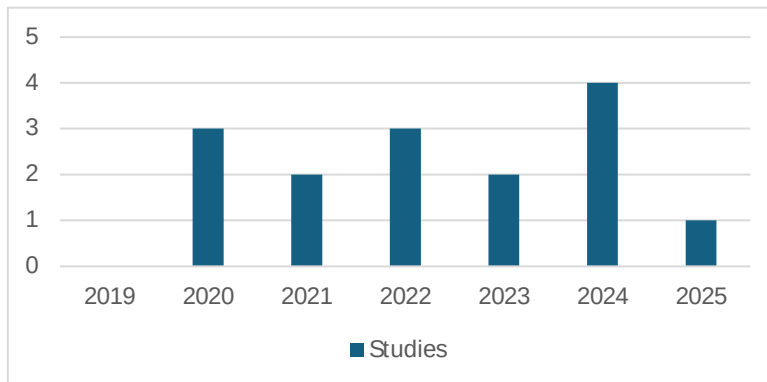
Table 1: Primary studies included in the review

| Primary studies | References                                                                                                                                                                                                                                                                                                                                       | Year |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| PS1             | Britto, R., Smite, D., Damm, L. O., & Börstler, J. (2020). Evaluating and strategizing the onboarding of software developers in large-scale globally distributed projects. <i>Journal of Systems and Software</i> , 169, 110699.                                                                                                                 | 2020 |
| PS2             | Moe, N. B., Stray, V., & Goplen, M. R. (2020). Studying onboarding in distributed software teams: a case study and guidelines. In <i>Proceedings of the 24th International Conference on Evaluation and Assessment in Software Engineering</i> (pp. 150-159).                                                                                    | 2020 |
| PS3             | Rodeghero, P., Zimmermann, T., Houck, B., & Ford, D. (2021). Please turn your cameras on: Remote onboarding of software developers during a pandemic. In <i>2021 IEEE/ACM 43rd International Conference on Software Engineering: Software Engineering in Practice (ICSE-SEIP)</i> (pp. 41-50). IEEE.                                             | 2021 |
| PS4             | Enberg, T., Alander, S., & Paasivaara, M. (2024). Onboarding for an agile software development company. In <i>International Conference on Agile Software Development</i> (pp. 144-162). Cham: Springer Nature Switzerland.                                                                                                                       | 2024 |
| PS5             | Turzo, A. K., Sultana, S., & Bosu, A. (2025). From First Patch to Long-Term Contributor: Evaluating Onboarding Recommendations for OSS Newcomers. <i>IEEE Transactions on Software Engineering</i> .                                                                                                                                             | 2025 |
| PS6             | Akdur, G., Aydin, M. N., & Akdur, G. (2024). Understanding virtual onboarding dynamics and developer turnover intention in the era of pandemic. <i>Journal of Systems and Software</i> , 216, 112136.                                                                                                                                            | 2024 |
| PS7             | Smite, D., & Moe, N. B. (2023). The role of responsiveness to change in large onboarding campaigns. In <i>International conference on agile software development</i> (pp. 132-148). Cham: Springer Nature Switzerland.                                                                                                                           | 2023 |
| PS8             | Tobisch, F., Schmidt, J., & Matthes, F. (2024). Investigating communities of practice in large-scale agile software development: an interview study. In <i>International Conference on Agile Software Development</i> (pp. 3-19). Cham: Springer Nature Switzerland.                                                                             | 2024 |
| PS9             | Perpétua, S. P., Peternelli, M. D. O., Portela, C. D. S., & Souza, M. R. D. A. (2024). Exploring the Practitioners Perspective on Remote Onboarding in Software Development Organizations. In <i>Proceedings of the XXIII Brazilian Symposium on Software Quality</i> (pp. 275-285).                                                             | 2024 |
| PS10            | Subramanian, V. N. (2020). An empirical study of the first contributions of developers to open source projects on GitHub. In <i>Proceedings of the ACM/IEEE 42nd International Conference on Software Engineering: Companion Proceedings</i> (pp. 116-118).                                                                                      | 2020 |
| PS11            | Rehman, I., Wang, D., Kula, R. G., Ishio, T., & Matsumoto, K. (2022). Newcomer oss-candidates: Characterizing contributions of novice developers to github. <i>Empirical Software Engineering</i> , 27(5), 109.                                                                                                                                  | 2022 |
| PS12            | Fronchetti, F., Shepherd, D. C., Wiese, I., Treude, C., Gerosa, M. A., & Steinmacher, I. (2023). Do contributing files provide information about oss newcomers' onboarding barriers?. In <i>Proceedings of the 31st ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering</i> (pp. 16-28). | 2023 |
| PS13            | Santos, F., Trinkenreich, B., Pimentel, J. F., Wiese, I., Steinmacher, I., Sarma, A., & Gerosa, M. A. (2022). How to choose a task? mismatches in perspectives of newcomers and existing contributors. In <i>Proceedings of the 16th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement</i> (pp. 114-124).       | 2022 |
| PS14            | Xiao, W., He, H., Xu, W., Tan, X., Dong, J., & Zhou, M. (2022). Recommending good first issues in github oss projects. In <i>Proceedings of the 44th international conference on software engineering</i> (pp. 1830-1842).                                                                                                                       | 2022 |
| PS15            | Alderliesten, J. W. D., & Zaidman, A. (2021). An initial exploration of the "good first issue" label for newcomer developers. In <i>2021 IEEE/ACM 13th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE)</i> (pp. 117-118). IEEE.                                                                          | 2021 |

## RESULTS

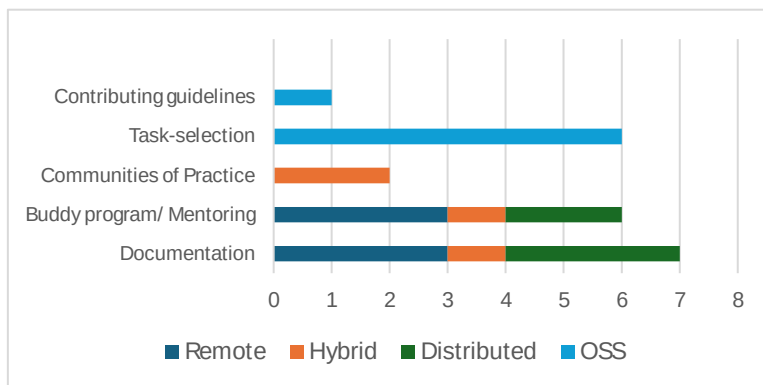
This study considers the onboarding process in remote, distributed and hybrid software teams as a KM mechanism, social mechanisms and initial tasks that serve to enter this process. This section presents a descriptive mapping of the 15 primary studies through three views: (1) annual distribution of papers; (2) coverage of key knowledge management practices across team contexts; and (3) distribution of

research designs. The results are based on the structured search and selection process described in the Methodology section and on the primary studies shown in Table 1. Figure 2 shows the distribution of primary studies in the period 2019-2025.



*Figure 2: Annual distribution of included primary studies (2019–2025)*

Figure 2 shows an increase in publications after 2020, which indicates growing attention to onboarding in remote and distributed software work. Figure 3 maps how often KM practices are identified in onboarding processes and by team context where they are all present (remote, distributed, hybrid, OSS).



*Figure 3: Coverage of KM practices across team contexts*

Documentation, handbooks, mentoring, and buddy programs appear most frequently in the reviewed studies, particularly in remote and distributed settings, which is typical when it comes to remote environments. Communities of Practice (CoP) are mostly expressed when it comes to larger organizations, while curation is particularly visible in the context of OSS.

Regarding research design, case studies and mixed-method studies dominate the corpus, while interviews, surveys, quantitative observational studies, and design-science studies appear less frequently. This distribution reflects the context-dependent nature of onboarding research but also indicates a need for more evaluative and metric-oriented studies on onboarding outcomes.

## LIMITATIONS

In accordance with the recommendations for Literature Review in Software Engineering (Zhou et al., 2016), the authors recognize threats to validity related to: (1) Search string construction and database selection; (2) Assessment of the quality of selected works and construction of inclusion and exclusion criteria; (3) Limited access to certain works that are available exclusively through subscription services. Details of the planning and execution of the works are given in section 3, which ensures the transparency of the findings to the primary studies and thereby increases the reliability of the presented conclusions. External validity is consciously limited to the domain of onboarding in KM in

remote, distributed and hybrid teams. Generalization beyond this domain was not intended, but the review process itself can be applied to other areas of software engineering.

## CONCLUSION

This structured literature review examined onboarding in remote, distributed, hybrid, and OSS software teams as a knowledge management process. The mapping of 15 primary studies from 2019 to 2025 suggests increasing research interest in onboarding as a KM-related process and indicates that effective onboarding practices often combine explicit artifacts, such as documentation and handbooks, with social mechanisms for tacit knowledge transfer, such as mentoring, buddy systems, and communities of practice. The findings should be interpreted as a focused mapping of recurring practices rather than as statistically generalizable evidence across all software team contexts. Future research should include dual screening and coding, broader multilingual search, and a more explicit quality assessment procedure adapted to different study types.

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