Emily Louisa Laue Christensen

Hybrid Work in Agile Software Development

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Abstract

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The rise of hybrid work, where employees work from diverse locations and with varying schedules, has introduced practical challenges for agile organizations and teams. This dissertation investigates how the shift from remote to hybrid work has influenced companies and teams within agile software development environments since the Covid-19 pandemic. The research aims to map the current state of the literature on the topic, and to explore organizational policies, team work arrangements and workspaces, and recurring meetings. The dissertation combines a systematic mapping of existing literature with empirical studies, including conceptual modeling and three exploratory case studies. Primary data were collected through 49 semi-structured interviews with participants from ten companies and analyzed using thematic analysis.

The results reveal a lack of empirical studies on hybrid work in agile software development and introduce a conceptual model and team typology that capture the complexity of software teams' hybrid work arrangements. The findings also reveal how agile companies and teams have evolved their policies and work arrangements post-pandemic into a diverse spectrum, ranging from fully flexible to more structured and aligned approaches. In addition, the findings highlight that seating systems can impact agile team workspaces and collaboration, and the importance of aligning the format of recurring meetings with their intent.

The dissertation proposes future directions for research, including exploring the topic across diverse cultural and regional contexts, and from people and product-related perspectives. For practitioners, it emphasizes that policies for hybrid work should be context-sensitive, and that free seating and check-in systems can improve space efficiency but may hinder collaboration if not aligned with team office presence. It also highlights the importance of selecting meeting formats based on intent, recommending remote for information sharing presentations and in-person for brainstorming, active discussions, and social bonding.

Keywords: hybrid work, agile software development, software team, policy, work arrangement, workspace, meeting, case study, systematic mapping study, thematic analysis

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Emily Louisa Laue Christensen
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Contents

List of publications

This dissertation is based on the following papers. The rights have been granted by publishers to include the papers in the dissertation. The same entries will also appear in the References in a standard format.

I. Šmite, D., Christensen, E. L., Tell, P., and Russo, D. (2023). The Future Workplace: Characterizing the Spectrum of Hybrid Work Arrangements for Software Teams. *IEEE software* 40, pp. 34–41. DOI: 10.1109/MS.2022.3230289

II. Khanna, D., Christensen, E. L., Gosu, S., Wang, X., and Paasivaara, M. (2024). Hybrid Work meets Agile Software Development: A Systematic Mapping Study. In: *Proceedings of the 2024 IEEE/ACM 17th International Conference on Cooperative and Human Aspects of Software Engineering (CHASE)*, pp. 57–67. DOI: 10.1145/3641822.3641863

III. Christensen, E. L., Cholvat, L. C., and Tell, P. (2025). On the Evolution of Agile Software Team Work Arrangements. *Journal of Systems and Software* 230, p. 112514. DOI: 10.1016/j.jss.2025.112514

IV. Christensen, E. L., Paasivaara, M., and Salman, I. (2025). Hybrid Work in Agile Software Development: Recurring Meetings. In: *Proceedings of the 2025 IEEE/ACM 18th International Conference on Cooperative and Human Aspects of Software Engineering (CHASE)*, pp. 120–130. DOI: 10.1109/CHASE66643.2025.00023

V. Broomandi, F., Christensen, E. L., and Paasivaara, M. (2025). One Size Does Not Fit All: How To Organize Hybrid Work in Agile Software Development? In: Accepted for publication in the *2025 ACM/IEEE 19th International Symposium on Empirical Software Engineering and Measurement (ESEM)*

In the dissertation, the publications are referred to as Publication I, Publication II, Publication III, Publication IV, and Publication V.

Author's contribution

Publication I: "The Future Workplace: Characterizing the Spectrum of Hybrid Work Arrangements for Software Teams"

I am the second author in Publication I. All authors participated in the study design. I conducted four of the interviews for the data collection with the third author, and I analyzed those interviews. The remaining two interviews were conducted and analyzed by the first author. All authors wrote the article. Visualizations were created by the first author.

Publication II: "Hybrid Work meets Agile Software Development: A Systematic Mapping Study"

I am the second author in Publication II. The study design was carried out by the first, second, fourth, and fifth authors. The first and third authors carried out the data collection. I was the main responsible for the data extraction. I carried out the data analysis with the first author. I wrote the article with the first, fourth, and fifth authors. Visualizations were created by the first author.

Publication III: "On the Evolution of Agile Software Team Work Arrangements"

I am the principal author and investigator in Publication III. All authors participated in the study design. I collected half of the data with the third author. The other half was collected by the second author. I was the main responsible for analyzing the data. All authors wrote the article. Visualizations were created by the third author.

Publication IV: "Hybrid Work in Agile Software Development: Recurring Meetings"

I am the principal author and investigator in Publication IV. All authors participated in the study design. I collected the data with the second and third authors. I was the main responsible for analyzing the data and writing the article. I created the visualizations. The second author was responsible for selecting and recruiting the case organizations.

Publication V: "One Size Does Not Fit All: How To Organize Hybrid Work in Agile Software Development?"

I am the second author in Publication V, which will also be included in the doctoral dissertation by the first author, Fateme Broomandi. All authors participated in the study design. I collected the data with the third author. The first author carried out the initial phases of data analysis. I carried out the following phases of data analysis and wrote the article with the first author. I created the visualizations. The third author was responsible for selecting and recruiting the case organizations.

Declarations

Turnitin

The originality of this dissertation has been reviewed with the Turnitin similarity checking service.

Commercial software

This dissertation was prepared with the help of the following commercial software:

NVivo - a qualitative data analysis software that is used for data coding, classification, and analysis. NVivo licensed software is provided by LUT University for the researchers. For the qualitative data coding and analysis, I utilized NVivo Pro 12 in Publication III, NVivo R1 in Publication IV, and NVivo 14 in Publication V.

AI use

During the preparation of this doctoral dissertation, Emily Louisa Laue Christensen, the author of the dissertation, used Microsoft 365 Copilot to refine the grammar of textual information in the summary of the dissertation. After using Copilot, the author reviewed and edited the content, and takes full responsibility for the content of the doctoral dissertation.

1 Introduction

1.1 Background and research motivation

Agile software development is currently the most widely adopted methodology in the industry (Digital.ai, 2023). Its global prevalence stems from the Agile Manifesto (K. Beck et al., 2001), which unified various lightweight development approaches and sparked a movement toward more adaptive practices (Hohl et al., 2018). The manifesto emphasizes values such as *"individuals and interactions over processes and tools"* and *"responding to change over following a plan"* (K. Beck et al., 2001), values that continue to shape the development of software across diverse organizational contexts. Historically, agile software development has depended on traditional collocated teams (Scrum Pattern Group, n.d.) to facilitate rapid communication, iterative feedback, and collaborative problem-solving (Dingsøyr et al., 2012). This supported practices such as the daily stand-up and the use of shared physical artifacts like task boards (Stray, Sjøberg, and Dybå, 2016).

However, when the Covid-19 pandemic accelerated the shift to remote work, the software industry was forced to transition rapidly to work from home (Šmite, Moe, Klotins, et al., 2023). Contrary to initial concerns, and despite initial challenges encountered, software professionals adapted swiftly, and many developers reported minimal disruption to their workflows (Oliveira Jr et al., 2020; Russo et al., 2021). These unexpectedly positive experiences, combined with investments in remote work infrastructure, led many employees in the software industry to reconsider the necessity of returning to traditional office environments (Šmite, Moe, Hildrum, et al., 2023), as well as outside the industry (Barrero, Bloom, and Davis, 2021), leading to a rise in hybrid work, where employees alternate between working in the office and at home.

Hybrid work has, in the post-pandemic period, become mainstream, and many organizations are now experimenting with new policies and hybrid work models to balance employee autonomy with operational needs (Guggenberger et al., 2023). This transition has created an urgent need to understand how agile methodologies, which originally relied on synchronous, in-person collaboration, can be adapted to hybrid settings.

Despite the growing prevalence of hybrid work, academic research on its intersection with agile software development remains limited. Most existing studies were conducted during the pandemic, and focused on the forced work from home scenario. These studies primarily address developer productivity and well-being (Neumann, Bogdanov, and Sager, 2022; Šmite, Moe, Klotins, et al., 2023; Cucolaş and Russo, 2023), and specific technical practices, such as remote pair programming (Smith et al., 2023), rather than the broader implications of hybrid work. There is a notable lack of empirical studies examining how agile teams navigate hybrid settings, particularly in terms of work location, scheduling, and team alignment.

In addition, traditional categorizations of software teams as either collocated or virtual (Šmite, Kuhrmann, and Keil, 2014) are no longer sufficient to describe the complexity of teams' hybrid work arrangements. This complicates the design and organization of agile practices, like agile meetings, raising questions about how to maintain agility and team collaboration in such evolving contexts. Furthermore, the role of the physical office and the workspace of teams have received limited attention, despite their central role in enabling collaboration and agile practices. Without a clearer understanding of these evolving dynamics in hybrid work, organizations risk misalignment between their policies and the needs of agile teams.

1.2 Research problem and questions

The rise of hybrid work, where employees work from diverse locations and with varying schedules, has introduced practical challenges for agile organizations and teams that need to be addressed. This limits the ability of software development organizations to support agile teams effectively, optimize meeting practices, and design office workspaces that meet evolving needs. In this dissertation, I aim to study the research problem: *"How has the shift from remote to hybrid work influenced companies and teams within agile software development environments since the Covid-19 pandemic?"*

I address the research problem by answering five research questions:

RQ1: To what extent has hybrid work in agile software development been studied, and what is the scope and distribution of existing literature across geographical regions and research perspectives?

RQ2: How have the organizational policies of agile companies regarding hybrid work evolved during and after the Covid-19 pandemic?

RQ3: How can the hybrid work arrangements of agile software teams be characterized, and how have these arrangements evolved during and after the Covid-19 pandemic?

RQ4: How do free seating and check-in systems affect the workspaces of agile software teams in hybrid work?

RQ5: How are recurring meetings organized for and influenced by hybrid work in agile software development?

1.3 Research aim and impact

This dissertation aims to unveil how the shift from remote to hybrid work has influenced companies and teams within agile software development environments since the Covid-19 pandemic. The research objectives are limited to the exploration of agile organizational

policies, team work arrangements and workspaces, and recurring meetings. The research also aims to map the current state of academic research on the topic of hybrid work in agile software development. To address these research objectives, I collected four qualitative data sets and approached them via an inductive conceptual analysis and typology development approach, a systematic mapping study, and thematic analysis.

My research offers insights into hybrid work in agile software development for both researchers and practitioners. I introduce a conceptual model and team typology of hybrid work arrangements of software teams that captures their complexity, and identify gaps in existing literature on the topic, particularly the lack of empirical studies and limited focus on people and product perspectives. Furthermore, I show how agile companies and teams have post-pandemic evolved their policies and work arrangements into a diverse spectrum, ranging from fully flexible to more structured and aligned approaches. I also highlight the impact of free seating and check-ins systems, showing that while they can support office space efficiency, they can also hinder collaboration if not aligned with team office attendance and distribution. Finally, I demonstrate how recurring meeting formats in hybrid work are best determined by intent, with in-person meetings preferred for brainstorming, active discussions, and to promote social bonding. Remote formats work well for sharing information via presentations, and hybrid formats can accommodate diverse participation needs.

1.4 Dissertation structure

The structure of this dissertation is as follows: The literature review in chapter 2 presents related and relevant studies. I then present the research problem and methodology in chapter 3, including the connection between the publications and the research questions, the research design, and the methods. An overview of the publications is presented in chapter 4, and the results for each research question are reported in chapter 5. The key findings are discussed in chapter 6, along with the implications for practice, threats to validity, and limitations. The conclusions are reported in chapter 7, which includes a summary of the results and research contributions of the dissertation, as well as directions for future research. Finally, I provide an appendix with the publications referred to in this dissertation.

2 Literature review

In this chapter, I review literature related to the dissertation. First, I introduce the various definitions of hybrid work. I then review empirical research on remote and hybrid work in agile software development, related to the four main subjects in this dissertation: organizational policies, team work arrangements, team workspaces, and meetings.

2.1 Hybrid work definitions

The concept of hybrid work emerged in the 1990s in seminal studies on telecommuting and the early use of information and communication technologies to support remote work and virtual organizations. One of the earliest conceptualizations came from Halford (2005), who described *"hybrid workspaces"* as a combination of organizational and domestic environments mediated through cyberspace. This framing highlighted how digital technologies could enable employees to work outside the traditional office, for example from home, while still participating in the organizational workspaces.

After the Covid-19 pandemic and the forced work from home scenario imposed by restrictions and lockdowns (Šmite, Moe, Klotins, et al., 2023), hybrid work swiftly became a popular umbrella label attributed to various work-related terms. For example, Fayard, Weeks, and Khan (2021) defined it as the movement of employees between a home workspace and an office building, in what they termed the *"hybrid office"*. In contrast, Google Workspace experts (Setty, 2021) and human resource expert Professor Gratton (2021) defined hybrid work in relation to flexibility around an employee's work location or their work hours, or both.

In software development, hybrid work has been defined more recently as a setting where *"some team members work mostly or completely from home, others mostly or completely from the traditional office, and others in some combination of the two—not quite distributed and not quite collocated but, rather, individuals working from anywhere and touching base with the office intermittently (Conboy et al., 2023)."* This definition reflects the diverse nature of hybrid work, where software professionals work from various locations and connect with the office periodically, but does not reflect work schedules or team level arrangements around office co-presence, or how work locations are mandated at the policy level of organizations. The terminology and vocabulary around these aspects are deconstructed, characterized, and defined through the research contributions of this dissertation.

2.2 Organizational policies and team work arrangements

During the pandemic, remote work, or work from home, became the norm across organizations, due to widespread lock-downs and social distancing requirements. This shift was investigated in studies of agile software development such as Ågren, Knoph, and Bernts-

son Svensson (2022), Cucolaş and Russo (2023), and Müller et al. (2023), which highlight how remote work was adopted or forced at the organizational level as a necessary response to public health measures. While remote work dominated the early pandemic period, some companies and teams began experimenting with hybrid work arrangements. For example, Smith et al. (2023) reported early instances of such experimentation in one agile organization, where some of the employees alternated between working remotely and in-person.

As the pandemic subsided, and health concerns lessened, more organizations experimented with hybrid work policies and team work arrangements, as reported for instance in the work of Sporsem and Moe (2022) where a Norwegian agile company opened their offices in the fall of 2021, but dictated in their guidelines that the software teams should decide how and where to execute their work. In accordance with this guideline, one of the two teams investigated (Sporsem and Moe, 2022) typically worked from the office two to three days a week, apart from a few members who never came to the office. The second team was split between two cities, and three members from one city were mostly present at the office, while those in the other city rarely showed up.

In response to the evolving situation, organizations adopted various workplace policies to manage team collaboration and location flexibility. Some agile organizations implemented flexible work policies, which allowed employees to choose their work location based on personal preferences. Research by Souza Santos, Adisaputri, and Ralph (2023), Neumann, Habibpour, et al. (2022), Kemell and Saarikallio (2023), and de Andrade et al. (2024) explored organizations with such policies. Interestingly, Šmite, Tkalich, et al. (2025) reported that one company with a flexible policy experienced unexpectedly high office attendance, suggesting that flexibility does not always lead to a preference for remote work.

In contrast, some companies adopted much more structured policy models. For instance, in the multinational corporation where Z. Wang et al. (2022) conducted a co-design research study on the hybrid work experience of software development teams, guidelines were created post-pandemic that established Mondays, Tuesdays, and Fridays as designated office days primarily reserved for collaborative in-person work, while Wednesdays and Thursdays were designated remote work days for focused standalone work sessions. Another example of a very structured hybrid work policy is provided by a participant in the study conducted by Canedo et al. (2023), where the work days in one organization were rotated throughout the week so that agile team members had at least one day to work from home, while ensuring the office was not left empty. In addition, two team members with similar roles were not permitted to work from home on the same day of the week in that organization (Canedo et al., 2023).

Other organizations implemented policies which provided some structure, such as requiring a certain amount of office presence in terms of a percentage of time, or a specific

amount of days per week, while still permitting some flexibility. For instance, in one of the companies investigated by Šmite and Moe (2022), the hybrid work policy permitted employees to work from home two to three days per week, while in another company the policy required employees to work from the office a minimum of 50% of the calendar year. Similar post-pandemic hybrid work policies are also reported by Šmite, Moe, Tkalich, et al. (2022) and Moe, Stray, et al. (2023), where software developers could spend two days working at home, and three days at the office.

Moreover, the decisions around work location were in other companies left to the discretion of the agile software teams, similar to the previously discussed guidelines in the Norwegian company investigated by Sporsem and Moe (2022). Post-pandemic, the software teams investigated by Liu, Stray, and Sporsem (2023) were permitted to design their own approach to hybrid work, due to a high degree of autonomy. Similarly, when offices first reopened in Norway, the software teams investigated by Molléri and Mohagheghi (2024) were allowed to decide how to handle the mix of work from home and work from the office, as the company did not initially have experience with work from home at a large scale. Another example is provided by Bablo, Marcinkowski, and Przybylek (2023), where work from the office was proposed for one day per week, but the decision on the chosen day was left to the teams and resulted from their needs at a given time.

Historically, software development teams have been categorized into two main types: traditional collocated teams (Scrum Pattern Group, n.d.), where members work in the same physical location, and more recent geographically dispersed, or 'virtual' teams (Šmite, Kuhrmann, and Keil, 2014). This categorization has allowed for the design of practices for teams sharing the same physical space, such as pair programming (Hannay et al., 2009), and has helped researchers explore the impact of geographical, temporal, linguistic, and cultural differences on globally dispersed teams (Herbsleb et al., 2001; Noll, Beecham, and Richardson, 2011). However, since the pandemic, new types of software team work arrangements are surfacing that do not conform to these two categories.

While there is growing interest in post-pandemic experimentation with team work arrangements and some studies do report on this aspect of hybrid work (e.g., Z. Wang et al., 2022; Bablo, Marcinkowski, and Przybylek, 2023), few studies focus specifically on the alignment of teams in their office co-presence. For example, Moe, Ulsaker, et al. (2024) explored the post-pandemic office co-presence patterns of 17 agile teams in a large telecommunications company and their findings showed significant variation in office co-presence practices. While some teams coordinated their office attendance to ensure in-person interaction, others had fragmented patterns with smaller subgroups attending the office simultaneously, and the remaining members rarely interacting in-person. Based on their findings, the authors emphasize that a high average office presence does not necessarily result in frequent team interactions, and they caution against the mistaken assumption that good average attendance levels guarantee regular in-person engagement (Moe, Ulsaker, et al., 2024).

Additionally, while the previously discussed studies have documented the organizational hybrid work policies post-pandemic, detailed accounts of how these policies developed over time are relatively rare. For instance, Molléri and Mohagheghi (2024) report that after the offices initially reopened post-pandemic, hybrid work guidelines were established based on four core principles, with each department granted the flexibility to incorporate the principles in a way that suited their work. Similarly, in Moe, Stray, et al. (2023) the hybrid work policy was changed from three days per week at the office, to a minimum of 50% office presence, after internal discussions in the company. This dissertation addresses these gaps in research by examining the evolution of hybrid work policies and team work arrangements over time, providing empirical insights into the adaptation and implementation of policies, and how the team work location, schedule, and alignment has evolved across different organizational contexts.

2.3 Team workspaces

When societies reopened after the pandemic, a unique opportunity emerged that allowed organizations to revisit, redesign, and challenge assumptions about the characteristics of the optimal work environment and the role of physical office spaces (Boland et al., 2020). This prompted considerations on whether to maintain, expand, reduce, or decentralize existing office workspaces (Hensher, Wei, and M. J. Beck, 2023), and companies began experimenting with office redesigns to meet the evolving needs of their employees. These efforts included, for example, repurposing the office spaces into collaborative hubs used primarily for team gatherings and in-person collaboration, rather than daily individual work (Vasel, 2020), aligning with trends noted by researchers such as Fayard, Weeks, and Khan (2021).

Despite the growing interest, there is still a limited body of research specifically examining these recent changes in office workspace design and usage. Some notable studies include Hensher, Wei, and M. J. Beck (2023), Appel-Meulenbroek et al. (2022), and Maier et al. (2022). Even fewer studies explore these developments in the context of agile software development. One such study is by Šmite, Moe, Tkalich, et al. (2022), who investigated employee office attendance during and after the pandemic in two agile software companies with hybrid work policies. Their findings revealed that office occupancy dropped below 50% after autumn 2021, resulting in half-empty office spaces. The authors discuss the potential implications of this trend, such as downsizing or repurposing office areas, and propose practical solutions like hot-desking, staggered shifts for office work, or leasing unused office space on days with low attendance (Šmite, Moe, Tkalich, et al., 2022).

However, solutions like free seating systems and hot-desking have also been shown to pose challenges for employees in hybrid work. For instance, when employees are unable to anticipate where and when their colleagues will be present at the office due to free seating systems, it can create instability and unpredictability (Duckert and Bjørn, 2025).

In addition, at the team level, when members were sitting several meters apart at the office, they used digital tools as if they were remote during meetings, without leveraging their physical proximity for more natural, in-person collaboration (Duckert and Bjørn, 2025). These observations illustrate how the actual use of office space can sometimes hinder collaboration rather than support it.

One strategy used to address these challenges at the team level is reported by Moe, Stray, et al. (2023), where an agile company introduced team zones with free seating to optimize office space while still maintaining team identity. Employee surveys showed that 78% of employees preferred fixed zones for teams, indicating the importance of spatial proximity for collaboration. Overall, these insights underscore the importance of thoughtful office planning and design in hybrid work, and are further discussed in relation to the results and findings of this dissertation concerning seating systems and agile team workspaces.

2.4 Meetings in agile

Typically, communication in agile software development is based both on ad hoc communication and on regular meetings, such as daily stand-up meetings (Stray, Sjøberg, and Dybå, 2016; Stray, Moe, and Sjoberg, 2020). Agile meetings, and in particular the daily stand-up, played a critical role in maintaining team cohesion in remote work during the pandemic. The daily meetings were not only used to update team members on progress, but also served as a vital mechanism for preserving the feeling of working together as a team (Ågren, Knoph, and Berntsson Svensson, 2022).

To better accommodate remote work the daily meetings were in some cases adjusted, with changes implemented in their duration and scheduling. For instance, some scrum teams shortened the daily meeting and scheduled it at times that were most convenient for team members, allowing for more flexibility in their routines (Gama and Simões, 2022). In contrast, other teams extended the length of daily meetings to allow for more thorough updates and discussions, reflecting the need for deeper engagement in the absence of informal in-person communication (Matos and França, 2022). In addition, innovative formats for daily meetings emerged as teams adapted to remote environments. For instance, one team replaced traditional verbal daily stand-ups with a written format in Slack, so team members could share their status reports at their convenience (Stray, Moe, Vedal, et al., 2022).

Teams also modified other agile meetings (Gama and Simões, 2022; Matos and França, 2022; Cucolaş and Russo, 2023), such as moving sprint retrospectives to more convenient times. Several studies showed that in general, more meetings were deemed necessary to address communication challenges in remote work during the pandemic (Mendonça et al., 2020; Tanner and Naidoo, 2021; Ågren, Knoph, and Berntsson Svensson, 2022; Souza Santos and Ralph, 2022). While this strategy was useful in some cases, others found it necessary to implement time for focused and uninterrupted work, by for example

scheduling specific days where no meetings were held (Müller et al., 2023; Reunamäki and Fey, 2023). Similarly, one concrete strategy which was said to improve productivity, was the reduction of unnecessary meetings (Marek, Wińska, and Dąbrowski, 2021).

Overall, these changes reflect a broader shift toward more deliberate and organized communication strategies in remote agile teams, which in turn can provide valuable insights for hybrid work settings, which may require similar adaptations, or potentially even adaptations that are more complex. When considering the future of work, more recent hybrid work settings where some team members are working from an office, and others work from home or remote, has introduced new communication challenges, such as unequal access to formal or spontaneous communication, which were more uniformly absent in full remote work during the pandemic.

For instance, Stray, Moe, and Semsøy (2025) found that hybrid meetings often suffer from asymmetric participation, with remote attendees engaging significantly less than their counterparts who were at the office. Technical issues such as poor sound quality and connection delays hindered remote participation. Social factors also played a role, with remote attendees struggling to enter conversations and missing non-verbal cues, and being excluded from informal pre- and post-meeting discussions. These asymmetries were especially problematic in hybrid meetings that lacked a clear speaking order, and for newly onboarded team members who benefited more from in-person communication. Regarding more concrete strategies to address the challenges of hybrid meetings, and the daily stand-up meeting in particular, Büyükgüzel and Mitchell (2023) and Büyükgüzel and Balaman (2023) found that attendees could maintain workflow continuity by adapting to disruptions and co-constructing shared spaces, for example, by ensuring visibility and audibility for remote attendees.

Hybrid meetings were also found by Z. Wang et al. (2022) to defeat the purpose of office work hours for agile teams, which should ideally be utilized for in-person collaboration, and fostering social interaction. Coordinating and leveraging office work deliberately, while limiting the number and frequency of hybrid meetings was recommended as a strategy to avoid this draw-back. Similarly, in their study of ‘work from anywhere’ coordination strategies, Sporsem and Moe (2022) found that teams avoid filling up their calendars with meetings during office days, to enable collaborative work, so large meetings and retrospectives were exclusively held on days where all participants worked from home. Regarding more informal communication in hybrid work, such as unscheduled meetings, Sporsem, Strand, and Hanssen (2022) showed how virtual rooms, for instance in Zoom and Discord, could help trigger spontaneous interactions among software team members. Additionally, small Slack channels with just a few members helped to create a sense of security, particularly for less experienced developers, which helped them to communicate more, and ask questions they otherwise might not be comfortable asking in larger channels (Sporsem, Strand, and Hanssen, 2022).

While the aforementioned studies focus primarily on meetings in remote work and hybrid meetings, such as the daily stand-up, as well as informal communication and unscheduled meetings, less attention in research has been given to how different types of recurring meetings in hybrid work are organized and carried out. Thus, this dissertation aims to provide insights into how a range of recurring meetings in agile environments are organized to accommodate hybrid work and how hybrid work in turn shapes their format and practices, thereby contributing to addressing the current scarcity of literature in this domain.

3 Research problem and methodology

In this chapter, I present the connections between the publications and the research questions addressed in this dissertation. I also describe the research design and methods used, including a timeline of the research activities, and the employed data collection and analysis methods.

3.1 Research problem and questions

The connections between the five research questions and the five publications in this dissertation are presented in Table 3.1. Answering each research question aims to provide insight on the overall research problem of how the shift from remote to hybrid work influenced companies and teams within agile software development environments since the Covid-19 pandemic.

Table 3.1: Connections between the research questions and the publications. "✓" denotes that the research question was directly addressed in the publication and "(✓)" denotes that the publication indirectly yielded results related to the research question.

Research question	Pub.I	Pub.II	Pub.III	Pub.IV	Pub.V
RQ1: To what extent has hybrid work in agile software development been studied, and what is the scope and distribution of existing literature across geographical regions and research perspectives?		✓			
RQ2: How have the organizational policies of agile companies regarding hybrid work evolved during and after the Covid-19 pandemic?			✓	(✓)	✓
RQ3: How can the hybrid work arrangements of agile software teams be characterized, and how have these arrangements evolved during and after the Covid-19 pandemic?	✓		✓	(✓)	✓
RQ4: How do free seating and check-in systems affect the workspaces of agile software teams in hybrid work?			(✓)		✓
RQ5: How are recurring meetings organized for and influenced by hybrid work in agile software development?				✓	✓

3.2 Research design and methods

In Publication I, the research objective was to develop a conceptual model and team typology of hybrid work arrangements of software teams. The research design is therefore best described as an inductive conceptual analysis and typology development approach, in line with the process described by Naeem et al. (2023). This approach enables researchers to ground their conceptual models in real data and was therefore ideal for constructing a nuanced model and typology of software team work arrangements that reflect the complex patterns of hybrid work.

To gain an overview of current literature in the area of hybrid work in agile software development and identify the quantity and type of research and results available within

it, a systematic mapping study (Publication II) was conducted based on the guidelines of Petersen, Feldt, et al. (2008), Petersen, Vakkalanka, and Kuzniarz (2015), Mourão et al. (2017), and Wohlin (2014). The primary goal of a systematic mapping study is to provide an overview of a particular research area, and identify the quantity and type of research and results available within it (Petersen, Feldt, et al., 2008). This research design was therefore appropriate to determine the scope of literature in the area of hybrid work in agile software development, and allow for a discovery of research gaps and trends (Petersen, Vakkalanka, and Kuzniarz, 2015).

To explore the organizational policies of agile companies regarding hybrid work, the work arrangements of agile teams, seating systems and team workspaces, and recurring meetings, three case studies (Publication III; Publication IV; Publication V) were designed and conducted following the guidelines of Yin (2018), Runeson and Höst (2009), and Verner et al. (2009). Publication III and Publication V utilized an exploratory multiple-case study design (Yin, 2018; Verner et al., 2009), while Publication IV utilized an exploratory single case study design. These research designs enabled me to gain a deep understanding of hybrid work within the agile software development context and draw meaningful insights from multiple perspectives.

Several theoretical perspectives were considered during the development of this dissertation. For instance, theories of coordination have been used to examine distributed and remote work (Souza Santos and Ralph, 2022; Stray, Moe, Vedal, et al., 2022), and Social Interference Theory has provided insights into workspace configurations and their influence on interaction and distraction (Appel-Meulenbroek et al., 2022). While these frameworks helped contextualize existing research, they were not applied to explore the phenomena investigated in this dissertation, as its aim was exploratory and focused on capturing the evolving practices and configurations of hybrid work in agile software development through empirical case studies. This approach prioritized inductive insights over deductive theory testing.

In the case studies, and in Publication I, primary data was collected via semi-structured interviews, and analyzed using thematic analysis (Braun and Clarke, 2006; Braun and Clarke, 2021). According to Braun and Clarke (2006) thematic analysis offers a flexible and accessible method to analyze qualitative data, allowing researchers to identify patterns and themes directly from the data, without being constrained by a specific theoretical framework. This makes it especially valuable in exploratory contexts, where participants' perspectives are not well understood, and researchers wish to remain open to multiple interpretations of the data. Thematic analysis can also facilitate the generation of rich and nuanced, yet complex, accounts of data, which is crucial in exploratory work. By collecting "thick" (Storey, 2016) qualitative data through interviews, and using thematic analysis to generate rich, detailed accounts of the data, more informative insights around the complexity of the phenomenon can be obtained.

To code and analyze the primary data in Publication III, Publication IV, and Publication V, a codebook thematic analysis approach was used (Braun and Clarke, 2021). In contrast with purely reflective thematic analysis, where no coding framework is used, and the themes are the final outcome, codebook thematic analysis involves the use of some structured coding frameworks for developing and documenting the analysis, and the themes can be refined, or new themes developed, through inductive data engagement and the analytic process (Braun and Clarke, 2021).

3.2.1 Research activities

The timeline of the research activities carried out in this dissertation can be viewed in Table 3.2. The data collection began in 2021, and the final data collection was carried out in 2024. The primary data collection activities conducted through the case studies, and the inductive conceptual analysis and typology development approach are shown in Table 3.2 as 'Dataset 1, 2 and 4', and the secondary data collection activities, conducted in the systematic mapping, are shown as 'Dataset 3'.

Table 3.2: Timeline of research activities.

Dataset	2021	2022	2023	2024	2025
Dataset 1	Data collection	Analysis	Pub.I		
			Follow-up data collection & analysis		Pub.III
Dataset 2		Data collection	Follow-up data collection & analysis		Pub.III
Dataset 3			Data collection & analysis	Pub.II	
Dataset 4			Data collection starts	Data collection ends & analysis	Pub.IV & Pub.V

3.2.2 Primary data collection and analysis

Using a convenience sampling strategy (Robson and McCartan, 2016) within the authors' networks, ten companies of different sizes and from different industry sectors were selected for Publication I, Publication III, Publication IV, and Publication V, which provided higher chances of obtaining a rich and diverse range of data. All of the selected companies were interested in learning about the various characteristics of post-pandemic hybrid work. For example, in the Finnish R&D site of Ericsson, which was investigated in Publication IV and Publication V, the hybrid work policies were in an experimental phase when the research began, and the site managers were interested to learn how different hybrid work policies and team work arrangements impacted collaboration and agile practices.

Primary data was collected via semi-structured interviews with a total of 49 participants from the ten companies. The interviewee and company details can be viewed in Table 3.3.

I conducted 43 of the interviews personally, either alone or together with one or more of my co-authors. The interviews with participants H2 and H3 were conducted by Šmite, the first author of Publication I, and the interviews with participants N1–N4 were conducted by Cholvat, the second author of Publication III.

Table 3.3: Primary data collection. Some companies are marked with an asterisk (*) to indicate that a pseudonym is used.

Dataset	Participant ID	Primary role	Company	Company domain	Duration	Publication
Dataset 1	H1	Manger	IBM	IT and consulting	59 min	Pub.I
	H2	Manager	Intersoft*	Media service	∼45 min	
	H3	Manager	Ericsson	Telecommunications	∼45 min	
	M4	Chief technology officer	Alfa*	Software	74 min	Pub.I & Pub.III
	M5	Product management director	Bravo*	Social media suite	100 min	
	M6	Tech lead	Charlie*	Software-as-a-service	70 min	
Dataset 2	N1	Tribe coach	Delta*	Banking sector	40 min	Pub.III
	N2	Agile coach	Echo*	Pay-tech solutions	56 min	
	N3, N4	Scrum master	Foxtrot*	Logistics sector	65 min	
Dataset 4	P1, P11, P16, P17, P27	Manager	Ericsson	Telecommunications	57–79 min	Pub.IV & Pub.V
	P6, P12, P13	Product owner			55–57 min	
	P5, P10, P19	Specialist			56–58 min	
	P2–P4, P7–P9, P14, P15, P18, P20–P26	Developer			52–67 min	
	R1, R9	Manager	Kempower	Electric vehicle charging solutions	29 & 50 min	Pub.V
	R4, R6	Product owner			57 & 65 min	
	R11, R12	Specialist			48 & 58 min	
	R2, R3, R5, R7, R8, R10	Developer			55–62 min	

The interview protocols used, which included the questionnaires, were planned in detail within the research teams, and can be viewed online in the supplementary materials for each publication. All the participants signed written consent forms which described the purpose and procedure of the studies, how outcomes would be used, and steps taken to maintain confidentiality. All of the interviews I conducted, with the exception of one, were carried out online via Zoom or Microsoft Teams, and were video recorded with the permission of the participants. One interview was carried out in-person and audio recorded only. The interviews in Datasets 1 and 2 were transcribed verbatim with Avrio software, and the interviews in Dataset 4 were automatically transcribed using the built-in Microsoft Teams functionality.

In the first phase of thematic analysis Braun and Clarke (2006), I manually reviewed the interview transcripts while listening to the video recordings, to familiarize myself with the data and ensure that the transcripts were correct, while simultaneously noting down ideas for codes. I generated initial codes in the second phase, using NVivo software, and clustered them under topics. In the third phase of analysis I refined and described all the generated codes, before sorting them into themes and sub-themes. I then further reviewed the themes in the fourth phase, and defined and named them in the fifth phase. In

Publication III, Publication IV, and Publication V, the last phase consisted of producing the final reports.

In Publication V the first two phases of analysis were conducted by the first author of the study, Broomandi, and I conducted the following phases jointly with the first author. In Publication III and Publication IV, I conducted all phases of the analysis solely, but held regular meetings with my co-researchers, to discuss and clarify the understanding of the data. The codebooks created can be viewed online in the supplementary materials for Publication III, Publication IV, and Publication V, along with excerpts of the data coding. In addition, Publication III provides an overview of the identified themes, their corresponding codes, the number of references for each code, and an example statement from the data for each code, to demonstrate the analysis process followed.

In Publication I, the process differed slightly from the above description, as the thematic analysis was purely inductive and aimed to develop a conceptual model and team typology of hybrid work arrangements, in line with the process described by Naeem et al., 2023. I analyzed four of the interviews (H1, M4–M6), used in Publication I, while the first author, Šmite, analyzed interviews H2 and H3. After the first five phases of thematic analysis were conducted, the entire research team deconstructed the terminology of hybrid work, by critically examining and clarifying the term 'hybrid' through the comparison of various definitions from literature, and the themes identified in Dataset 1. An additional step was then taken by the entire research team to create a unique representation of the data, in the form of a conceptual model depicting a team typology and spectrum of work arrangements for software teams. The model is illustrated and described in the results chapter (Section 5.3.1), and served to answer the research objective of the study, and encapsulate the findings and insights derived from the data.

Moreover, the analysis process in Publication III included a deductive step after the first two phases, where I instantiated the team typology and conceptual model proposed in Publication I, with the data. The conceptual model developed in Publication I was further refined by the research team, by introducing classifications for the geographical distribution of software team members, which were also instantiated in the data during this step.

3.2.3 Data collection and analysis for the mapping study

To collect the literature which comprised Dataset 3, both database searches and snowballing were conducted, in line with the hybrid search strategy proposed by Mourão et al. (2017). Snowballing was applied to the papers identified via the databases, as well as key background papers (e.g., Conboy et al., 2023), as using alternative methods to identify additional papers can prove beneficial (Wohlin, 2014). The mapping process followed in Publication II can be viewed in Figure 3.1. After defining the research questions, and reviewing the scope, three academic databases (IEEE Xplore, Scopus, and ACM Digital

Library) were used to conduct the search for relevant literature. The query used in the databases combined three groups of keywords related to 'hybrid work', 'agile', and 'software development'. The full string of keywords used can be viewed in Publication II. In IEEE Xplore, the search was conducted via the *metadata* field, while the *title*, *abstract*, and *keyword* fields were used in Scopus and ACM. In total, 3,191 papers were identified. Figure 3.1 shows the exact number of papers identified from each database.

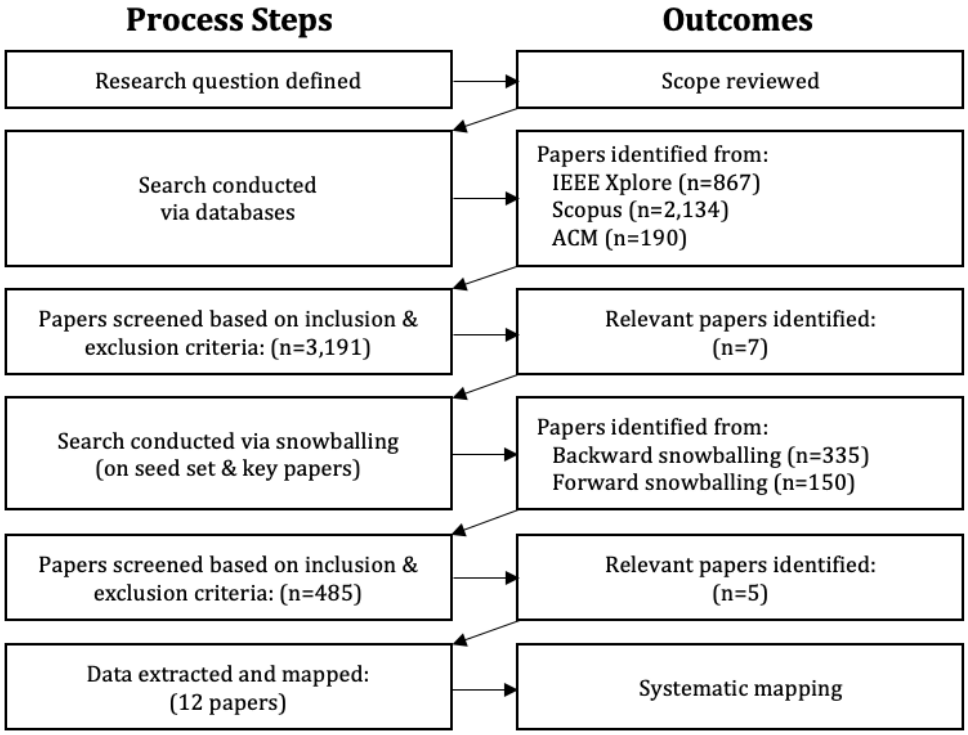

Figure 3.1: Mapping process for Publication II.

The 3,191 papers were screened according to the inclusion criteria, i.e., studies conducted in professional agile software development settings with hybrid work, and the exclusion criteria, which included studies outside hybrid work or agile contexts, studies in non-professional settings, or non-English papers. The scope was also limited to studies published since the establishment of the Agile Manifesto (K. Beck et al., 2001). Papers had to meet all inclusion criteria and fit none of the exclusion criteria to be included. The first and third authors, Khanna and Gosu, independently screened titles and abstracts using Parsifal, and exported the results to Google Sheets. Each paper was then classified as accept, reject, maybe, or duplicate. This resulted in 756 duplicates, 2,409 rejections, and five accepted papers. The remaining 21 'maybe' papers were reviewed collaboratively by four authors, myself included, ensuring consensus in the selection process. After discussion, two more papers were reclassified as accepted, bringing the total to seven relevant papers.

Snowballing was then conducted on the seven relevant papers identified, and key back-

ground papers. Backward snowballing from references in the seed set and key papers produced 335 papers, while forward snowballing via Google Scholar added 150, totaling 485 papers. Metadata was exported to Google Sheets, and screened using the same criteria described above. Five more relevant papers were identified in this step, bringing the final total to 12: seven from database searches and five from snowballing.

It should be noted here that only one round of snowballing was conducted in the mapping, which does not align with the guidelines of Wohlin (2014), who recommends multiple iterations of backward and forward snowballing until no new papers are found. However, a second round was performed post-report on the five papers identified through snowballing, following the same procedure described above. This yielded 110 potentially relevant papers, but none met the inclusion criteria after screening. Therefore, this deviation from the recommended guidelines did not have any implications for the results.

I then extracted the data from the 12 identified studies to a Google Sheet, and the first author, Khanna, checked it for correctness. The analysis process consisted of tabulating the information for each item extracted, and illustrating the information in Publication II. Visual illustrations were used to present the publication trends and characteristics of the reviewed studies, while descriptive tables illustrated the mapping of research questions and the hybrid settings agile software development was carried out in. The research questions and objectives were mapped according to the conceptual framework for organizing research questions on hybrid work in software engineering by Paasivaara and X. Wang (2022), which is visualized in Figure 3.2.

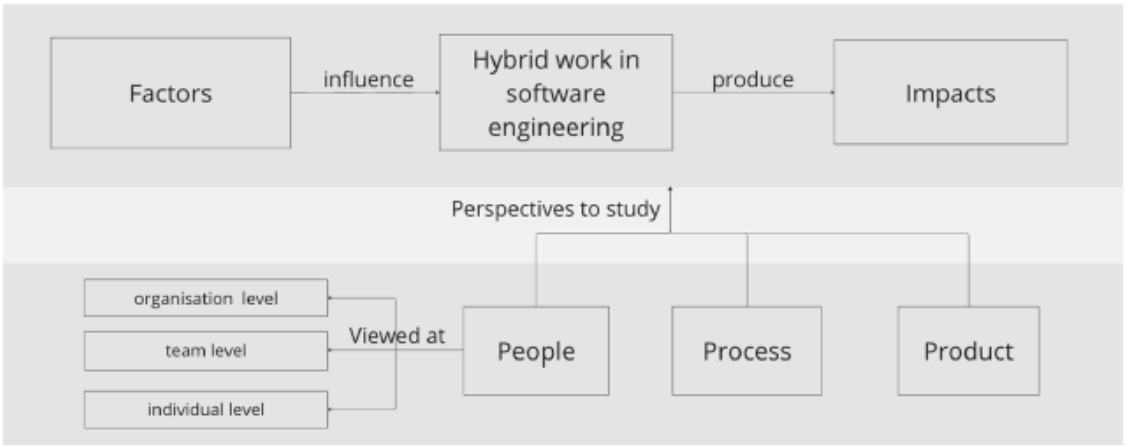

Figure 3.2: Conceptual framework for organizing research questions on hybrid work in software engineering (Paasivaara and X. Wang, 2022).

4 Overview of the publications

In this chapter, I provide an overview of the publications in this dissertation, including the research objectives, and their relation to the whole project.

4.1 Publication I

The objective of Publication I: *The Future Workplace: Characterizing the Spectrum of Hybrid Work Arrangements for Software Teams* was to develop a conceptual model, and team typology of hybrid work arrangements of software teams, to avoid the confusion that seemed to be prevalent in the discourse about hybrid work. The terminology related to the future workplace was deconstructed and boundaries of hybrid work in teams were set. A selection of empirical insights, which showcased archetypes of the defined work arrangements, were provided, based on six interviews with team leads and managers from six different companies in Denmark and Sweden.

Publication I contributed to this dissertation by developing a conceptual model and team typology of hybrid work arrangements of software teams, based on their work location, schedule, and alignment. The results of Publication I are presented in Section 5.3.1. As this was the first study in this dissertation project, the model provided a framework for classifying the agile software teams investigated in the following stages of the research, according to their hybrid work arrangements.

4.2 Publication II

The objective of Publication II: *Hybrid Work meets Agile Software Development: A Systematic Mapping Study* was to provide a comprehensive mapping of how hybrid work is being studied and practiced within the context of agile software development. The six research questions for this study are shown in Table 4.1. To answer the research questions, a systematic mapping study was conducted. Relevant literature was collected via database searches and snowballing, and the extracted data was tabulated and illustrated through descriptive tables and visual figures.

Table 4.1: Research questions in Publication II.

RQ1: What are the publication trends and characteristics of existing research on hybrid work in agile software development?
RQ1.1: What are the publication years and types of research articles on hybrid work in agile software development?
RQ1.2: Which research methods have been employed in the published studies for hybrid work in agile software development?
RQ1.3: In which countries and organizations has the research been carried out for hybrid work in agile software development?
RQ2: Which research questions have been investigated in hybrid work in agile software development?
RQ3: In which kind of hybrid settings is agile software development carried out?

Publication II contributed to this dissertation by providing a comprehensive mapping of how hybrid work is being studied and practiced within the context of agile software development. The key findings of Publication II are presented in Section 5.1. The study

highlighted a research gap that aligned with the focus of the following publications I had already planned for this dissertation. Specifically, the three planned case studies would focus on the people perspective of hybrid work, at both team and organizational levels (see Figure 3.2), which had received limited attention in prior literature. The results of Publication II confirmed the relevance of this focus, reinforcing the value of investigating the planned topics. The study also identified additional critical gaps in the existing body of knowledge on hybrid work in agile software development, which are discussed in the future directions for research proposed in the conclusions of this dissertation (Section 7.2).

4.3 Publication III

The objective of Publication III: *On the Evolution of Agile Software Team Work Arrangements* was to explore how the work arrangements of agile software teams and the policies of companies evolved during and after the Covid-19 pandemic. The two research questions for this study were: "RQ1: How have the work arrangements of agile software teams and the policies of companies evolved during and since the Covid-19 pandemic?" and "RQ2: What are the effects of the evolving work arrangements?". To answer the research questions, an exploratory multiple-case study of 28 agile teams was conducted, based on interviews with seven individuals in leadership and support roles, from six Danish companies.

Publication III contributed to this dissertation by further extending the conceptual model, and team typology of hybrid work arrangements of software teams developed in Publication I, to include the geographical location of team members, thereby providing a more comprehensive framework for understanding the work arrangements of software teams. These results are presented in Section 5.3.1. The study then exemplified how the extended conceptual model and team typology could be instantiated with a dataset, through detailed descriptions and visual illustrations of the 28 agile software teams' work arrangements evolution over the course of three years. These results are presented in Section 5.3.2. The study also provided insights into how the organizational policies of the six companies evolved in the same time period, which are presented in Section 5.2. Finally, the study identified several effects of the evolution, including the impact of organizational policies on the physical workspace of agile teams, which are presented in Section 5.4.

The results of Publication III highlighted the emergence of a dynamic spectrum of software team work arrangements and organizational policies. However, they also raised important questions about the workspaces and practices of agile teams. In addition, the study highlighted the need to capture a broader range of experiences, particularly those of developers and other employees in agile organizations who are not in leadership or support roles. In response, my co-authors and I decided to refine the focus of the two remaining planned publications. We placed greater emphasis on exploring the workspaces and practices of agile teams, such as recurring meetings, and expanded our data collection

to include a wider variety of roles within the investigated companies. This ensured that the following studies would more effectively address the gaps and limitations identified in Publication III, and provide a deeper understanding of hybrid work in agile settings.

4.4 Publication IV

The objective of Publication IV: *Hybrid Work in Agile Software Development: Recurring Meetings* was to explore how recurring meetings are organized and carried out in hybrid work in agile software development. The research question for this study was "How are recurring meetings organized and carried out in hybrid work in agile software development?". To answer this research question, an exploratory single case study was conducted, based on interviews with 27 employees at the Finnish R&D site of Ericsson, a global telecommunications company.

Publication IV contributed to this dissertation through an in-depth exploration of agile practices in hybrid work in agile software development, specifically highlighting how recurring meetings are organized and carried out in two different units at Ericsson. These results are presented in Section 5.5. The study also indirectly yielded insights into the organizational polices and work arrangements of agile software teams post-pandemic, which are presented in Sections 5.2 and 5.3.2.

4.5 Publication V

The objective of Publication V: *One Size Does Not Fit All: How To Organize Hybrid Work in Agile Software Development?* was to explore how different companies organize their guidelines, infrastructures, events, and communities for hybrid work in agile software development. The research question for this study was "How do different companies organize their guidelines, infrastructures, events, and communities for hybrid work within agile software development environments, considering their unique settings and contexts?". To answer this research question, an exploratory, comparative multiple case study was conducted, based on the 27 interviews used in Publication IV with employees at Ericsson, and 12 additional interviews with employees at Kempower, a young Finnish industrial company.

Publication V contributed to this dissertation through an in-depth exploration of organizational policies, seating systems and team workspaces, and recurring meetings in hybrid work in agile software development, by comparing the two previously mentioned units at Ericsson, and one unit at Kempower, highlighting how the organizational context influences hybrid work. These results are presented in Sections 5.2, 5.4, and 5.5. Similar to the previous publication, Publication V also indirectly yielded additional insights into the work arrangements of agile software teams post-pandemic, which are presented in Section 5.3.2. Based on the findings, the study provided actionable recommendations for companies navigating or considering hybrid work adoption in agile software development.

5 Results

In this chapter, I present the results and key findings from the publications included in this dissertation. These findings were derived from Publication I; Publication II; Publication III; Publication IV; Publication V and are presented in the following sections, in answer to each of the five dissertation research questions.

5.1 Literature extent, geographical regions, and perspectives

This section describes the results and key findings of the systematic mapping study conducted in Publication II in answer to RQ1: *To what extent has hybrid work in agile software development been studied, and what is the scope and distribution of existing literature across geographical regions and research perspectives?*

Extent and geographical regions: The systematic mapping identified 12 studies on hybrid work in agile software development, which are listed in Table 5.1 according to the year of publication. While most focused specifically on hybrid work, some of the identified studies also addressed remote work in agile contexts. The main findings related to hybrid work from each study are summarized in Table 5.1.

Only two of the reviewed studies (S1, S2) were published before the Covid-19 pandemic, while six were published in 2022, and four in 2023, reflecting a recent rise in research interest on the topic. Despite this growing interest, the systematic mapping identified only twelve studies in total, which was fewer than expected. Therefore, the first key finding of the systematic mapping is that hybrid work in the context of agile software development remains under-researched.

The mapping of the author affiliations and organizations studied, and their locations, revealed that the research was primarily conducted in European countries (see Figure 5.1), with half of the studies carried out in five different organizations located in the Nordic countries. Only one study was conducted outside of Europe (S8), in the USA, by researchers affiliated with the University of California and SAP Labs in the USA, and the Pontifical Catholic University of Rio Grande do Sul, in Brazil. Hence, the second key finding of the mapping was that the reviewed studies mainly investigated European organizations, with Nordic organizations dominating the trend.

Research perspectives studied: In total, 19 research questions or objectives were investigated in the reviewed studies, and these were mapped according to the 'conceptual framework for organizing research questions on hybrid work in software engineering' (Paasivaara and X. Wang, 2022), shown in Figure 3.2).

Regarding the perspectives studied, i.e., people, process, and product, the mapping revealed that a large amount of the research questions (n=11) were mapped solely to the

Table 5.1: Studies identified in systematic mapping (Publication II).

ID	Authors and year	Study title	Main findings related to hybrid work
S1	Deshpande et al. (2016)	Remote Working and Collaboration in Agile Teams	In hybrid agile teams, collaboration opportunities are imbalanced between remote and co-located members, making collaborative platforms and communication mechanisms crucial for integrating remote members' capabilities and supporting meaningful engagement.
S2	Lous et al. (2018)	From Scrum to Agile: a Journey to Tackle the Challenges of Distributed Development in an Agile Team	A distributed and hybrid agile team can overcome the challenges of distance by fostering a reflective culture focused on trust, virtual collaboration, and continuous process improvement to achieve speed and simplicity.
S3	Neumann, Habibpour, et al. (2022)	What Remains from Covid-19? Agile Software Development in Hybrid Work Organization: A Single Case Study	Agile software developers prefer remote work but anticipate hybrid arrangements, requiring flexible policies, a deeper understanding of agile practices, and improved office infrastructure to support effective collaboration.
S4	Šmite, Moe, Tkalich, et al. (2022)	Half-Empty Offices in Flexible Work Arrangements: Why are Employees Not Returning?	Despite upgraded office spaces, employees prefer remote work due to long commutes, better home-office setups, and focused work conditions, making hybrid arrangements the likely future norm.
S5	Sporsem and Moe (2022)	Coordination Strategies When Working from Anywhere: A Case Study of Two Agile Teams	Agile teams working from anywhere can coordinate effectively by choosing tasks based on location, using virtual rooms to maintain informal communication, and choosing location based on meeting type.
S6	Sporsem, Strand, and Hanssen (2022)	Unscheduled Meetings in Hybrid Work	Hybrid software teams maintain effective unscheduled meetings by experimenting with virtual rooms and using small Slack channels to ask questions.
S7	Tkalich, Šmite, et al. (2022)	What happens to psychological safety when going remote?	Remote and hybrid work can challenge psychological safety in software teams by reducing spontaneous interaction, but aligned work arrangements and supportive rituals and norms can help preserve it.
S8	Z. Wang et al. (2022)	Co-Designing for a Hybrid Workplace Experience in Software Development	A co-design approach involving diverse software roles can help shape a flexible, collaborative hybrid work model that balances deep work with in-person interaction and adapts continuously to team needs.
S9	Bablo, Marcinkowski, and Przybylek (2023)	Overcoming Challenges of Virtual Scrum Teams: Lessons Learned Through an Action Research Study	Introducing one on-site workday per week helped Scrum teams improve collaboration, facilitate onboarding, and maintain team cohesion, offering a balanced compromise between remote flexibility and the benefits of in-person interaction.
S10	Büyükgüzel and Balaman (2023)	The spatial organization of hybrid Scrum meetings: A multimodal conversation analysis study	Hybrid Scrum meetings require participants to actively manage spatial visibility and audibility across co-located and remote settings to maintain mutual understanding between team members.
S11	Büyükgüzel and Mitchell (2023)	Progressivity in Hybrid Meetings: Daily Scrum as an Enabling Constraint for a Multi-Locational Software Development Team	Hybrid Scrum teams maintain progressivity by prioritizing work continuity over resolving technical disruptions, using structured meeting frameworks to coordinate across locations and ensure shared understanding.
S12	Kemell and Saarikallio (2023)	Hybrid Work Practices and Strategies in Software Engineering - Emerging Software Developer Experiences	Hybrid work enables software developers to balance productivity and well-being by flexibly choosing work modes, but its success depends on intentional practices that foster social interaction, collaboration, and onboarding.

process perspective, while five research questions were mapped to the people perspective (see Publication II). An additional six research questions were mapped to both the process and people perspective. Within the people perspective, the individual level was most prominent, with nine of the research questions approaching the topic at this level. Only

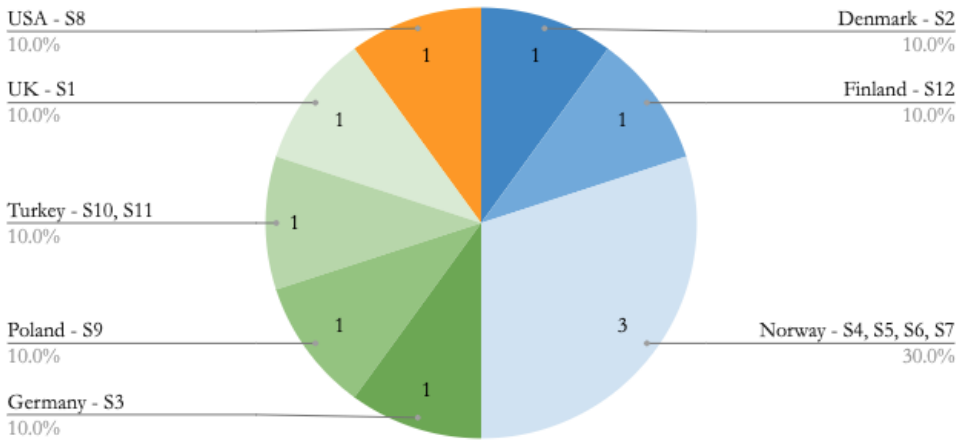

Figure 5.1: Geographical location of the organizations investigated in the studies.

two research questions approached the topic at the team level, and one at the organization level. The mapping did not reveal any research questions in the studies that could be mapped to the product perspective. Thus, the third key finding of the mapping is that the process perspective is the primary area of focus in research on hybrid work in agile contexts.

5.2 Organizational hybrid work policies

This section describes the results and key findings of Publication III, Publication IV, and Publication V pertaining to hybrid work policies during and after the Covid-19 pandemic, in answer to RQ3: *How have the organizational policies of agile companies regarding hybrid work evolved during and after the Covid-19 pandemic?*

Policy definitions: I have labeled and defined seven different types of organizational policies for hybrid work, and two types of traditional work polices, based on the findings in this dissertation. My labels and definitions of the policies are shown in Figure 5.2. The two traditional policies, *office* and *remote*, require employees to be physically present at the office, or allow employees to work fully outside the office, respectively. The seven hybrid work policies cover a wider spectrum and are labeled as: *office-first*, *fixed*, *semi-fixed*, *event-driven*, *team-driven*, and *event-triggered*, and *flexible*.

As shown in Figure 5.2, several of the hybrid work policies are characterized by predetermined schedules where employees are required to work from the office or meet in-person for a specific number of days per week, or at scheduled intervals (i.e., *fixed*, *semi-fixed*, *event-driven*, and in some cases *office-first*), in line with what Conboy et al. (2023) describe as a 'calendar-based approach'. This approach stands in contrast to the *event-triggered* policy, where in-person activities are organized in response to certain trigger events, rather than a scheduled time-frame.

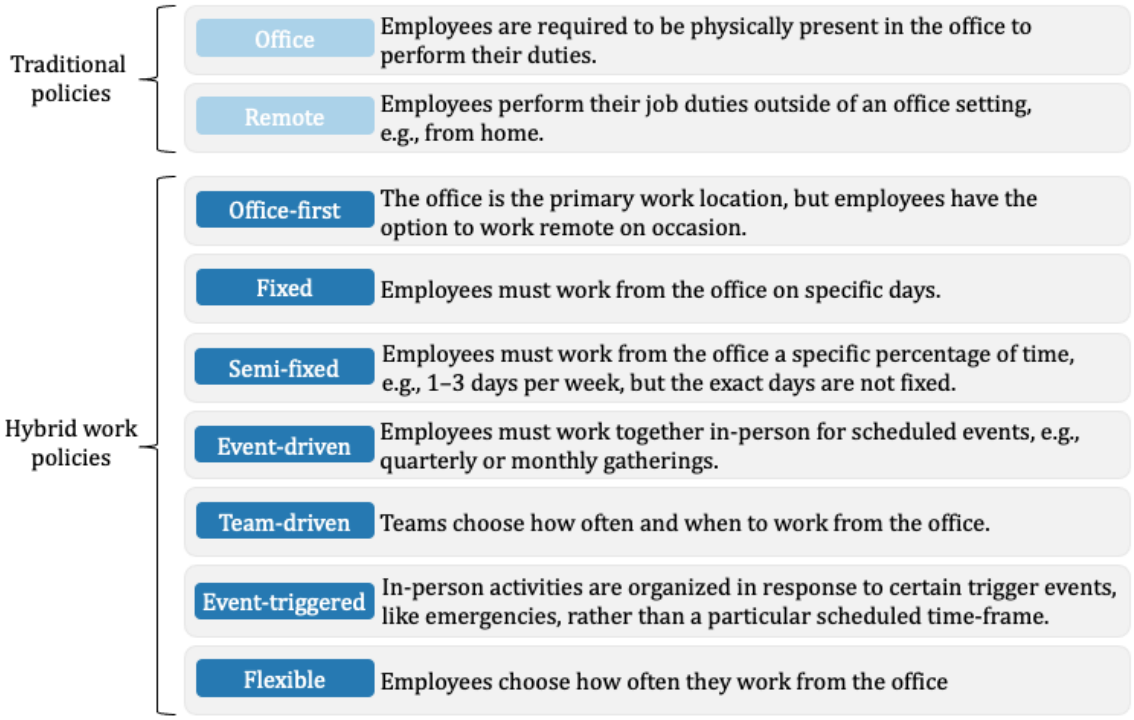

Figure 5.2: Definitions of organizational policies for traditional and hybrid work.

Table 5.2 provides an overview of each company the various policies were identified in, along with an exact description of how the post-pandemic work policy is implemented in each company. For two of the companies, Ericsson and Kempower, only the post-pandemic policy from 2024 is shown in the table, and described in the following, as the data collection was limited to information on the current work situation in those companies. The policies in Ericsson are also limited to two units in the research and development department of one Finnish site (Unit 1 and 2), and may differ in other sites.

Previous polices: The results of Publication III show that five of the companies investigated in this dissertation shifted from an *office-first* hybrid work policy to a *remote* work policy during the pandemic. Only one company, Delta, implemented the traditional *office* policy before the shift to a remote policy. This is noteworthy, as prior to the pandemic, traditional office policies were typically considered the norm. However, the interviews with company leaders and managers in Publication III revealed that the policies were more nuanced than might be expected, as there were often exceptions permitted for specific individuals to work remote, or for employees to work from home on occasion, e.g., one day per week or per agreement with managers.

Additionally, while four companies shifted their policies directly from *office-first* to *remote* during the pandemic, two companies implemented more nuanced policies at this time. One of these companies was Delta, where in addition to the *remote* policy, a very

Table 5.2: Previous and post-pandemic organizational policies for traditional and hybrid work in the investigated agile companies.

Company	Previous policies	Post-pandemic policy and year	Post-pandemic policy implementation
Alfa	From Office-first to Remote	Flexible & Event-triggered (2023)	"Freedom with responsibility": Policy is flexible, but work from the office is enforced on an ad hoc basis for specific teams and team members.
Bravo	From Office-first to Remote	Flexible (2023)	Employees have the flexibility to choose their preferred work location on a daily basis, either at the office or from home, based on their personal preferences and needs.
Charlie	From Office-first to Remote	Semi-fixed (2023)	Employees are mandated to be in the office at least a couple of times per week.
Delta	From Office to Remote & Event-triggered	Semi-fixed (2023)	A general guideline is established for employees to spend three days a week at the office, and two days working from home.
Echo	From Office-first to Fixed to Remote & Event-triggered	Flexible (2023)	"Very flexible": The company does not have any policies regarding the work location of employees.
Foxtrot	From Office-first to Remote	Flexible (2023)	Employees can combine both remote and office-based work.
Ericsson (Unit 1)	–	Fixed (2024)	Employees are expected to work at the office every Tuesday and Thursday.
Ericsson (Unit 2)	–	Semi-fixed (2024)	Employees are expected to work at the office two days per week.
Kempower	– –	Event-driven & Team-driven (2024)	Employees are required to meet in-person for "unit day" events every six weeks, otherwise the teams define their own needs.

specific provision was made which allowed 5% of employees to work from the office during certain periods within the pandemic period. So, the organizational policy in Delta during the pandemic is best classified as both *remote* and *event-triggered*.

In the second company, Echo, a similar provision was made for employees with critical functions to work from the office, or for employees to obtain permission to work from the office from their managers, so the organizational policy in Echo during the pandemic is also best classified as both *remote* and *event-triggered*. However, prior to that shift, at the start of the pandemic, all the employees in Echo were split into two groups, which alternated working from home every other week, in what is classified as a *fixed* hybrid work policy. These results highlight the key finding that organizational policies for hybrid work were more nuanced than expected, both prior to and during the pandemic.

Post-pandemic polices: As shown and described in Table 5.2, the *flexible* policy, which allows individual employees to choose how often they work from the office, was the most prevalent in the investigated organizations post-pandemic, as it was implemented in four of the eight companies. The *semi-fixed* policy, where employees must work from the office a specific percentage of time, but without fixed days, was the second most

prevalent, with three instances in the eight companies. The four remaining policies, i.e., *fixed, event-triggered, event-driven*, and *team-driven*, were implemented in one company each.

One of the companies (Ericsson) implemented two different variations of their hybrid work policy post-pandemic, in the two units investigated in Publication IV and Publication V. Additionally, two of the companies implemented a combination of two different policies defined in Figure 5.2. One of these companies is Alfa, where the hybrid work policy is *flexible*, but work from the office is simultaneously enforced on an ad hoc basis for specific teams and team members, for example, based on project deadlines, so the policy is also classified as *event-triggered*. Similarly, in Kempower, the hybrid work policy is both *event-driven* and *team-driven*, as all employees must meet in person every six weeks for a scheduled event, but the rest of the time the teams choose how often and when to work from the office.

Interestingly, when comparing the various approaches taken in the post-pandemic hybrid work policies, five of the companies rely on predetermined schedules through *fixed, semi-fixed* and *event-driven* policies. In contrast, only Alfa enforces in-person activities ad hoc through their post-pandemic policy (i.e., *event-triggered*), as previously discussed. Taken together, these results together provide the basis for the second key finding on organizational policies: post-pandemic, flexible hybrid work policies and those based on predetermined schedules for either office presence or in-person events were the most prevalent.

5.3 Agile software team work arrangements

This section describes the results and key findings of Publication I, Publication III, Publication IV, and Publication V pertaining to the characterization of agile software team work arrangements and their evolution during and after the Covid-19 pandemic, in answer to RQ3: *How can the hybrid work arrangements of agile software teams be characterized, and how have these arrangements evolved during and after the Covid-19 pandemic?*

5.3.1 Characterization of work arrangements

In this section, I present the team typology and multidimensional model of work arrangements (see Figure 5.3) that emerged through the inductive conceptual analysis and typology development approach that was taken in Publication I, and was further elaborated in Publication III. The three core dimensions of the model are the work location, the work schedule (Figure 5.3 – horizontal axis), and the degree of alignment of individual work modes in the team (Figure 5.3 – vertical axis). Within the alignment dimension, the spectrum ranges between fully flexible arrangements, partially aligned arrangements, and fully aligned arrangements.

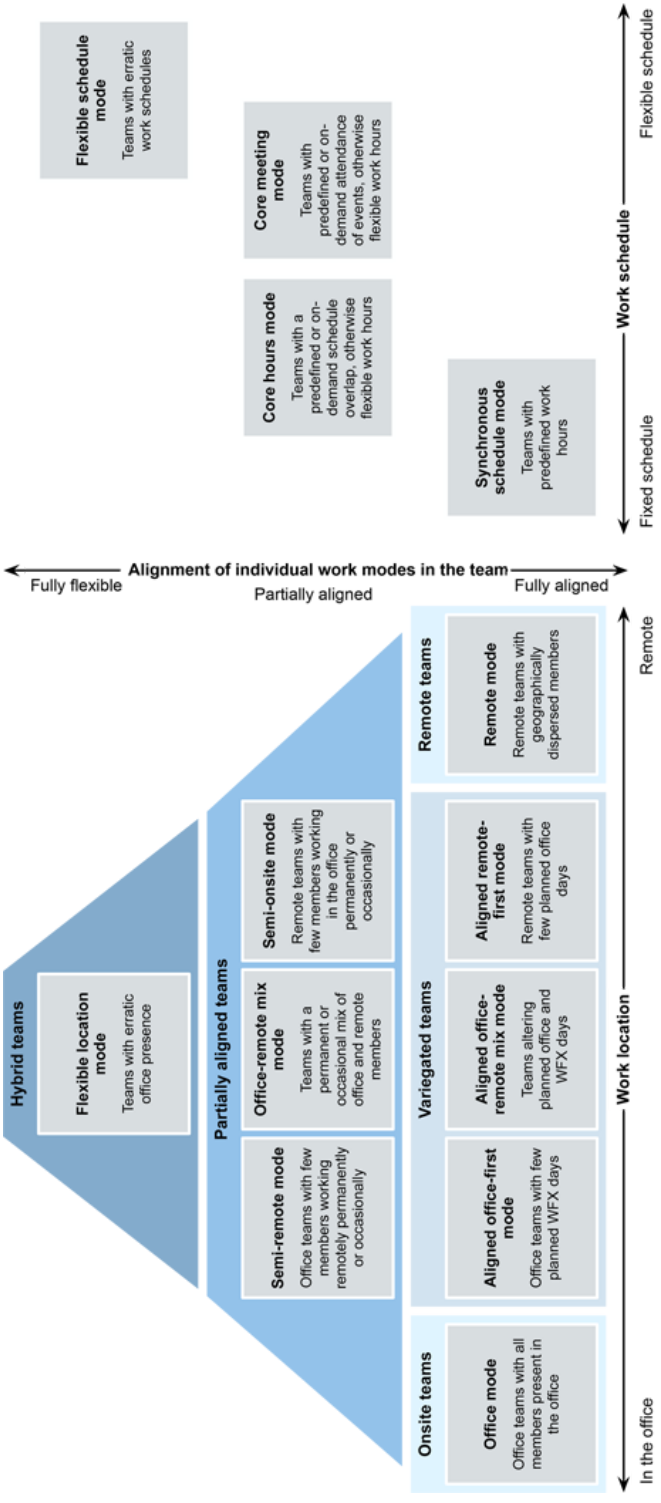

Figure 5.3: Team typology and model of work arrangements (Publication I © 2022 IEEE).

Hybrid teams: Teams working in a fully *flexible location* mode are defined in the model as 'hybrid teams', and are distinguished by their erratic office presence, as individual team members may be working from any location, such as from home, from the office, or from anywhere else. Similarly, teams with erratic work schedules, with no alignment on their work hours, are defined as working in *flexible schedule* mode.

Partially aligned teams: Partial alignment within teams can occur when members have differing work location arrangements, or when they don't consistently align. To simplify the degree of alignment in these 'partially aligned teams', three archetypical work location modes are defined in the model: *semi-remote*, *office-remote mix*, and *semi-onsite*. These three modes represent clusters of team arrangements that fall somewhere between fully flexible and fully aligned location modes. For instance, a team where most members work from home, while one or two members work from the office permanently or on occasion would be classified as a 'partially aligned team', working in *semi-onsite* mode.

On the work schedule dimension, partial alignment occurs when team members work within predefined *core hours*, or align their work hours around scheduled meetings or events, in *core meeting* mode, but otherwise have flexible schedules. For example, a team working in *core hours* mode may agree to work every Monday–Friday between 09:00 and 14:00, but outside of those hours, members may work very early in the morning, late at night, or even on weekends, based on their personal preferences.

Variegated teams: Fully aligned teams with predefined but altering work locations, are defined in the model as 'variegated teams'. The three different archetypical work location modes in the model represent varying degrees of office co-presence: *aligned office-first*, *aligned office-remote mix*, and *aligned remote-first*. For instance, a team where all members are copresent at the office the same two days every week would be classified as a 'variegated team', working in *aligned office-remote mix* mode, as they are consistently alternating their office presence in a fully aligned fashion. On the work schedule dimension, a fully aligned team works within the same predefined hours, in what is defined in the model as *synchronous schedule* mode. For instance, every team member might work between 09:00 and 17:00 on weekdays only.

Onsite and remote teams: Finally, the model also distinguishes between 'onsite' and 'remote' teams, where all members are defined as working in *office* mode and *remote* mode, respectively. These teams fall under the fully aligned spectrum of work location arrangements, but are distinguished from variegated teams because all members are either present in the office, or are geographically dispersed.

Team distribution: To provide a more comprehensive conceptual framework for understanding the work arrangements of software teams, the team typology from Publication I was further extended in Publication III to include the geographical location of team members:

- *Collocated teams*: All members operate from the same physical location (Šmite, Kuhrmann, and Keil, 2014).

- *Partially dispersed teams*: One or a few members are situated in different locations, compared to the majority who are based in the same physical location (Sharp, Giuffrida, and Melnik, 2012).

- *Dispersed teams*: Most or all members are distributed across various locations (Braithwaite and Joyce, 2005).

5.3.2 Evolution of work arrangements

In this section, I present the results from Publication III, Publication IV, and Publication V pertaining to the evolution of agile software team work arrangements, based on the team typology and model of work arrangements described in Section 5.3.1. In total, the results reveal how the work arrangements evolved in 48 agile teams, as is illustrated in Figure 5.4. For 15 of the teams, the exact work arrangements are shown in Figure 5.4, including the location, schedule, and team distribution.

For the remaining 33 teams, some details are not illustrated in Figure 5.4. First, for the 20 teams from Ericsson (Units 1 and 2) and Kempower, only post-pandemic arrangements are shown, as Publication IV and Publication V did not collect data about the pandemic period. Second, the schedules of eight teams from Echo are not included. These teams are dispersed across different time zones, and their schedules are internally agreed upon by team members. The company participant was therefore unable to provide team specific schedule details. Additionally, post-pandemic some Echo teams adopted an *aligned remote-first* mode, while others transitioned to a *flexible location* mode, but the exact numbers were not specified. Finally, five Alfa teams working in either a *synchronous schedule* or *core meeting* mode transitioned from *remote* mode, to either *office* or *semi-remote* mode post-pandemic. However, the company participant did not specify exactly how many teams worked in the various modes.

Work arrangements during the pandemic: The results show that the pandemic and the forced work from home situation triggered the first shift to remote work location arrangements, which was observed in all of the agile teams (Figure 5.4). Given that team members were working from home, their geographical locations varied, characterizing all the teams as *dispersed*. Interestingly, the eight teams in Echo shifted first to a fully aligned *office-remote mix* mode, prior to shifting to *remote* mode, based on the initial fixed company policy for alternating work from home and work from the office every other week (see Section 5.2).

While employees in Echo with critical functions were permitted to work from the office during the pandemic, as were 5% of employees in Delta (see Section 5.2), the participants

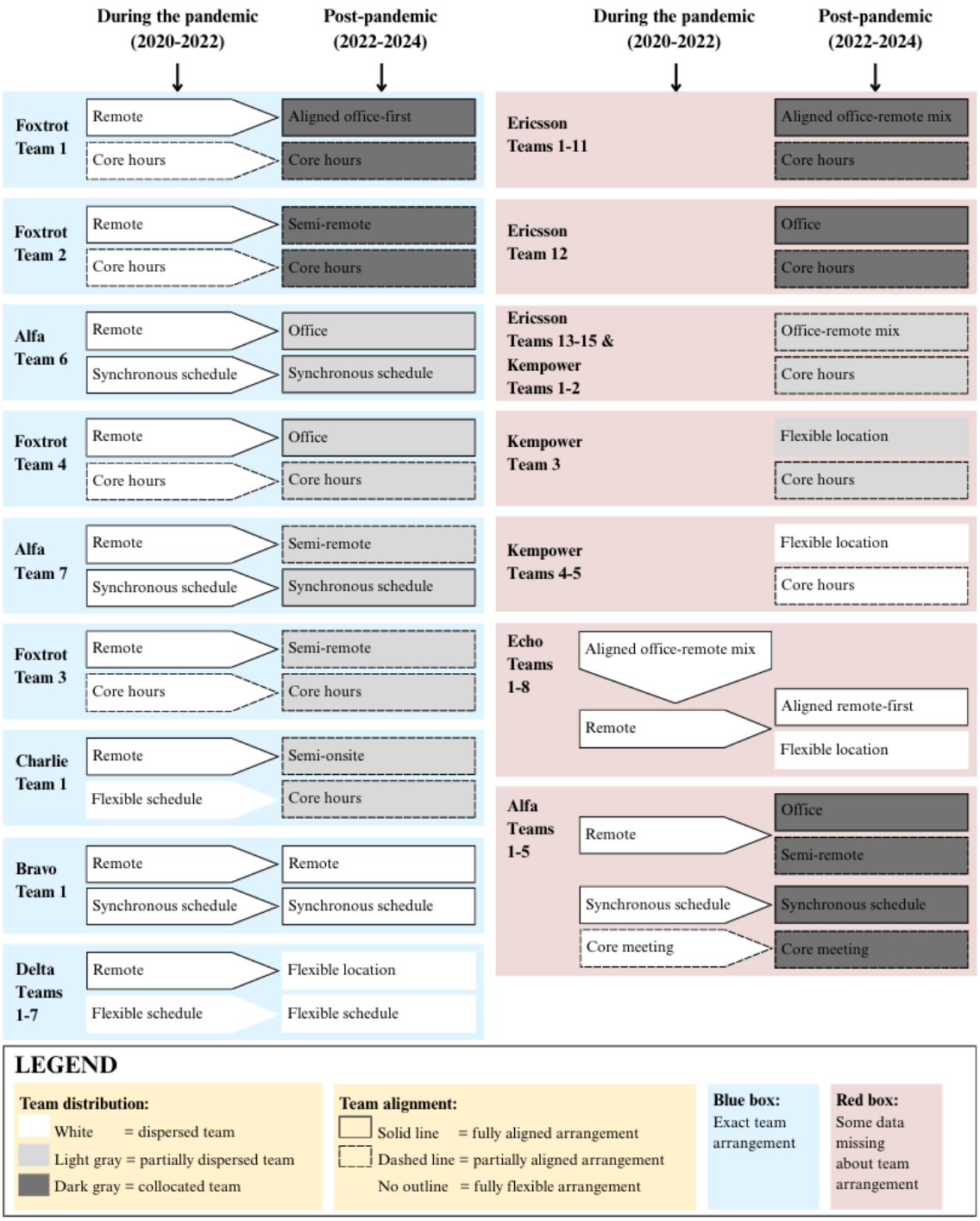

Figure 5.4: Evolution of agile team work arrangements.

from those two companies stated that all their teams worked from home, so it is possible that no team members utilized this opportunity, or that employees who did were not members of the teams investigated.

The team work schedules were more varied during the pandemic in their alignment. As shown in Figure 5.4, the team in Bravo and more than two of the teams in Alfa were fully aligned in *synchronous schedule* mode, while the seven teams in Delta and the team in Charlie worked in a *flexible schedule* mode, with no alignment in their schedules. Additionally, the four teams in Foxtrot all aligned closely on specific time slots where they worked virtually together as a team or attended meetings like retrospectives, but otherwise had flexible working hours, classifying their schedule arrangement as partially aligned in *core hours* mode. Similarly, some of the teams in Alfa were partially aligned in *core meeting* mode.

Work arrangements post-pandemic: The initial shift to *remote* mode was then followed by an evolution into multiple different work location arrangements post-pandemic. As shown in Figure 5.4, only the team in Bravo continued to work in *remote* mode, while between four to eight teams in Alfa, Foxtrot, and Ericsson shifted to *office* mode. All seven teams in Delta, three teams in Kempower, and some of the eight teams in Echo shifted to *flexible location* mode, with no alignment in their office presence. Eleven teams in Ericsson, one team in Foxtrot, and some teams in Echo shifted to fully aligned work modes, with predefined but altering locations, classifying them as variegated teams. Finally, three teams in Ericsson, two teams in Foxtrot and Kempower, the team in Charlie, and some of the teams in Alfa shifted to partially aligned work location modes.

Regarding the geographical location of team members, 18 of the teams in Bravo, Delta, Echo, and Kempower remain classified as *dispersed* teams post-pandemic. In 19 of the teams, in Alfa, Ericsson, and Foxtrot, all members worked from the same offices, when not working from home, classifying them as *collocated* teams. A smaller number of teams are classified as *partially-dispersed* post-pandemic, with 11 teams in Alfa, Charlie, Ericsson, Foxtrot, and Kempower having one or a few members located in different locations, compared to the majority who work from the same office.

The evolution of the agile teams into multiple different location work modes during the post-pandemic period was in some cases driven by the team members themselves and permitted by the companies through flexible work policies. For example, in Foxtrot where employees could combine remote and office-based work post-pandemic (see Section 5.2), two agile teams were fully aligned in *office* and *aligned office-first* modes, respectively, while the other two were partially aligned in *semi-remote* mode. In other cases, experimentation was done at the policy level, which in turn shaped the team work arrangements. For instance, in Ericsson unit 1 where employees were required to work from the office Tuesdays and Thursdays, this resulted in a fully aligned work location arrangement for the six teams in that unit. Both of these approaches resulted in deviations from traditional arrangements, like *office* and *remote*, and allowed the emergence of new and more fluid team arrangements.

While the team work location arrangements evolved into multiple different modes post-

pandemic, only the team in Charlie changed their work schedule during this time period, shifting from a fully flexible schedule to a partially aligned schedule, in *core hours* mode. When taking all of the post-pandemic schedule arrangements into account, the most prevalent alignment modes were the two partially aligned arrangements, with 24 teams working in *core hours* mode, and some additional teams working in *core meeting* mode. Only the teams in Delta maintained their *flexible schedule* mode post-pandemic, while the team in Bravo and some of the teams in Alfa maintained their *synchronous schedule* mode.

Overall, the key findings illustrate a clear evolution in agile team work arrangements, beginning with Echo's early and unique location alternation. All the teams later transitioned into diverse post-pandemic location modes shaped by both team-level and organizational decisions, and adopted varied work schedules, most notably, partially aligned core hours.

5.4 Seating systems and team workspaces

This section describes the results and key findings from Publication III, Publication IV, and Publication V regarding the seating systems and workspaces of the agile teams, in answer to RQ5: *How do free seating and check-in systems affect the workspaces of agile software teams in hybrid work?*

During the pandemic, four of the six companies (Alfa, Charlie, Delta, and Echo) from Publication III implemented different free seating and check-in policies and systems in the offices, like hot desking, to limit the number of employees working at the same time. Similarly, at the time of data collection for Publication IV and Publication V both Ericsson and Kempower used a hot desking system where most employees did not have assigned desks, and had to book one when coming to the office.

In the interviews with the participants from Delta, Echo, and Ericsson, it became apparent how these check-in systems can prevent agile teams from having an effective workspace. The participant from Delta highlighted how the free seating policy collided with team's need to have their own work area, while the participant from Echo noted that they sometimes felt they disturbed others while talking to their team members at the desks, since the seating system placed them near people they weren't collaborating with. In Ericsson, despite the free seating, the majority of the teams in both units would almost always try to sit together at the same desks when they were onsite. Only one team said that the members were more often spread out in the open office area when they worked onsite.

Similar to the participants from Delta and Echo, frustration with the hot desking system was expressed by six of the participants from the two units in Ericsson, who highlighted the difficulty of finding seats near their team members. In addition, the Ericsson participants also voiced frustration with the system at the individual level, noting that not being able to leave personal belongings at the desks added extra effort when coming to

the office, making it inconvenient.

Interestingly, although Kempower also implemented a hot desking system, participants from the company did not express any frustration with it. In contrast with most of the teams in Ericsson who were collocated, the teams in Kempower were all dispersed or partially dispersed across multiple offices and only a few team members, if any, were typically copresent at the same office, so there was less of a need for fixed team workspaces. In fact, hot desking was viewed positively, especially for accommodating visiting colleagues from other cities. Additionally, the hot desking policy at Kempower ensured that employees who worked in the office four to five days a week were assigned permanent desks, which was seen as a supportive measure.

While concerns around the free seating systems were not voiced by the participants from Alfa and Charlie, the team from Charlie was partially dispersed, as were several of the teams from Alfa, as shown in Figure 5.4. Team members may therefore have experienced less need for fixed team workspaces, similar to the teams in Kempower. Thus, the key finding regarding seating systems and workspaces is that, although setups like hot desking can enhance space efficiency, they may also disrupt team cohesion and collaboration if not aligned with team distribution and office attendance patterns. It should also be noted that some of the case companies have continued to refine their office design and policies around the seating systems after the data collection for this dissertation. For example, after the interviews were conducted at Ericsson, the two units shifted to having fixed desks and team workspaces.

5.5 Recurring meetings in hybrid work

This section describes the results and key findings from Publication IV and Publication V regarding meetings, in answer to RQ6: *How are recurring meetings organized for and influenced by hybrid work in agile software development?*

Three main types of recurring meetings were held in the two units in Ericsson (Unit 1 and 2) and the unit in Kempower: unit meetings, information sharing meetings, and community of practice (CoP) meetings. The format and intent of these meetings are described in the following, along with a summary of recurring agile team meetings at Ericsson and participant preferences regarding hybrid work meetings in general. A detailed overview of the agile team meetings in Ericsson from Publication IV is illustrated in Figure 5.5.

In-person meetings: Kempower organized a full-day in-person *unit day* every six weeks for all unit employees. The agenda included workshops, demos, strategic discussions, social activities, new colleague introductions, and appreciation segments. The event served to strengthen cross-team relationships and support collaboration with colleagues who might not otherwise meet on a day-to-day basis, which in turn made it easier to cooperate virtually. Similarly, every 10 weeks, Unit 1 held a full-day in-person *unit day*,

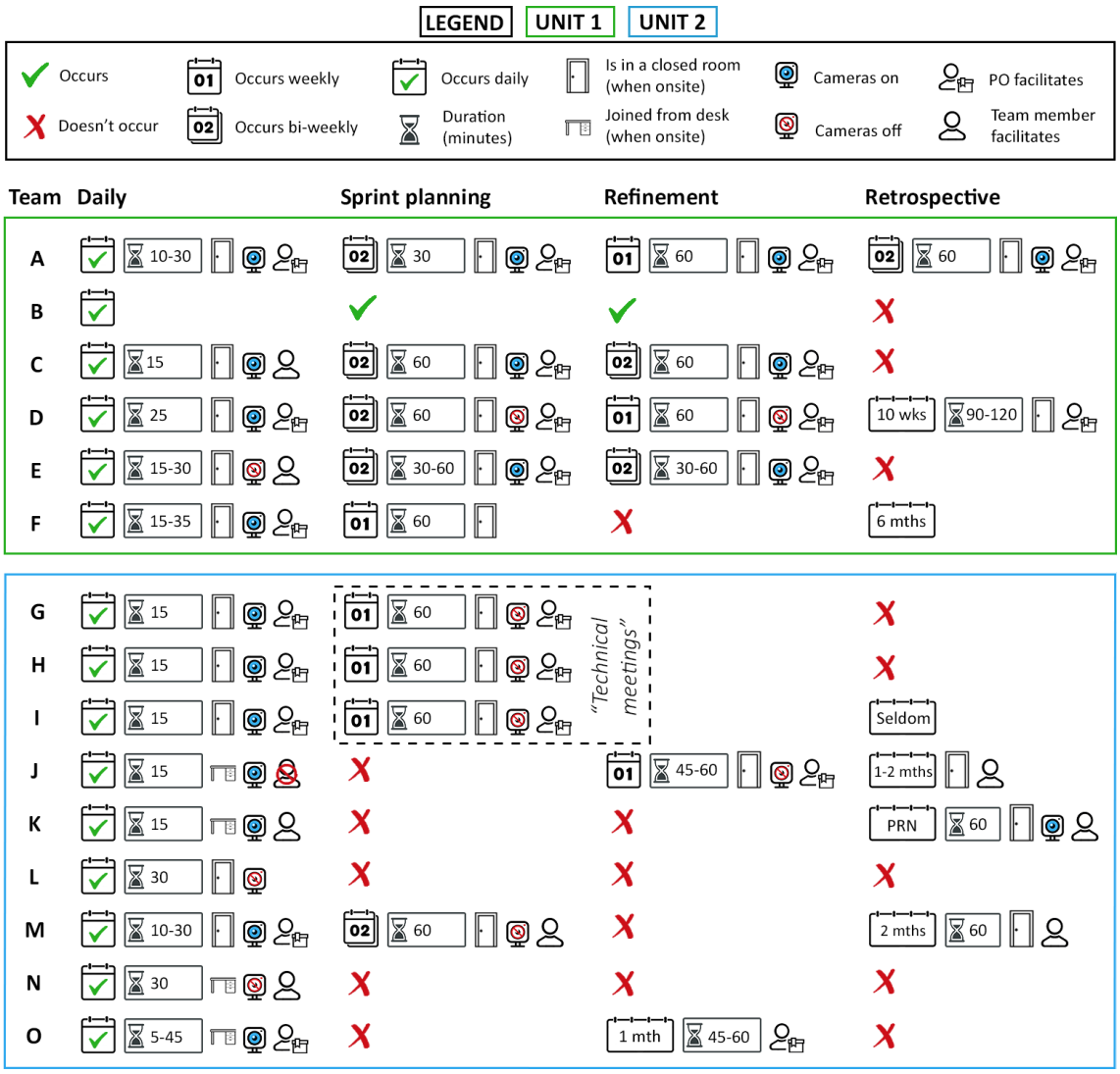

Figure 5.5: Agile team meetings in Ericsson (PRN = as needed). From Publication IV © 2025 IEEE.

which included an increment change presentation session led by the product owners and product management, followed by a common retrospective with group discussions. The participants especially valued the retrospective component for fostering team learning and cohesion. Additionally, twice a week, on Tuesdays and Thursdays, Unit 1 held informal 20-minute *information sharing* coffee meetings. These in-person meetings promoted social bonding, provided informal updates, and helped integrate new employees.

The five agile teams in Unit 1 in Ericsson held weekly or bi-weekly *sprint planning and backlog refinement* meetings in-person (see Figure 5.5), and the format was considered essential for in-depth team discussions and user story planning. Of the seven teams in

both Ericsson units that conducted their own *retrospectives*, most preferred an in-person format for the meeting, so the retrospectives were typically booked for days when all members were at the office, and lasted 1–2 hours.

Regarding meetings in general, six Ericsson participants mentioned that they preferred to have meetings that involve brainstorming in-person, as this allowed for more spontaneous discussion and the use of physical whiteboards. Six Ericsson participants also found in-person meetings useful for other reasons, for example, because it was easier to ask questions.

Remote meetings: In Unit 1 at Ericsson, a *sprint review* was held bi-weekly on Mondays for the entire unit, and all participants attended remotely. The program manager delivered presentations or demos, and there was the possibility for discussion at the end of the meeting. The format was chosen in this unit for its effectiveness when delivering presentations to larger audiences. Every two weeks on Wednesdays, a designated remote work day, Unit 2 it Ericsson conducted a *sprint change* event. The event began with product knowledge sharing in plenum, continued with summaries from team coaches, and ended with team breakout sessions for sprint planning. A shared Confluence page was also used to support documentation and visibility for all unit employees. The remote format was specifically chosen to accommodate cross-site collaboration.

Similarly, two managers and one product owner from Ericsson highlighted their preference for scheduling meetings involving international attendees on remote working days, because the other attendees were also remote. Time zone differences among the sites also contributed to this preference. Most of the agile teams in Unit 2 carried out their sprint planning during the sprint change event, minimizing the need for additional planning meetings. However, one team from Unit 2 did conduct out an additional bi-weekly remote sprint planning meeting specifically for their team (see Figure 5.5).

Hybrid meetings: At the unit level, all hybrid meetings took place in Unit 2 at Ericsson and at Kempower. Unlike Ericsson's Unit 1, where office days were *fixed* according to unit policy and meetings could be planned as either fully in-person or remote, Unit 2 and Kempower had no fixed office days. This led to the use of a hybrid format for the meetings discussed below.

Bi-weekly on Fridays, Unit 2 in Ericsson held a 30-minute hybrid *information sharing* session, which included an appreciation segment, product and business updates, and dynamic discussions like tech talks. The hybrid format ensured accessibility for all employees and suited the end of the week timing. Unit 2 also held open CoP meetings for all unit employees 2–3 times per week. The hybrid format allowed for flexible participation and most attendees joined via MS Teams, but meeting rooms were occasionally booked at the office as well. Topics were suggested in advance via Confluence, and meetings were skipped if no topics were proposed.

In addition, the closed security and testing CoPs in Unit 2 in Ericsson met up to three times per week, typically in hybrid format. While a room was booked at the office for the meetings, attendees often joined from their desks, and MS Teams was used simultaneously for remote access. The closed testing CoP meetings were often joined by international site employees to ensure alignment, so the hybrid format supported this cross-site collaboration while maintaining flexibility. Similar guild meetings were held weekly or biweekly in a hybrid format, in Kempower. The guilds were also cross-team, role-based communities, such as architects, designers, testers, and coaches, that supported collaboration beyond the core responsibilities community members had in their agile teams. The guild meetings had flexible duration and were canceled if no topics arose. Scheduling, documentation, and follow-ups were managed by the guild masters via Confluence, while Slack channels supported ongoing asynchronous communication.

Three of the agile teams in Unit 2 in Ericsson had weekly one-hour time slots for *technical meetings* (see Figure 5.5), similar to the sprint planning meetings held by the teams in Unit 1. A hybrid format was always used for these meetings, as the team members were not always all copresent at the office simultaneously. Cameras were not used during the technical meetings, as members were focused on the shared Jira board.

Alternating meeting format: Unit 1 in Ericsson held one-hour open CoP meetings in-person every Thursday, aligned with one of the unit's office days. These meetings were ideal for topics that were best suited for in-person discussions. Additionally, a 30-minute virtual open CoP meeting was held every Friday in Unit 1, aligned with one of the units' remote workdays. This format supported flexible participation and remote-friendly topics, like presentations. The closed architecture CoP in Unit 1 held weekly two-hour meetings that also alternated between in-person and remote formats. This alternating format was decided on to ensure the architects were available for informal discussions with developers when at the office, addressing previous concerns about their availability for ad hoc conversations outside their community meetings.

All 15 teams in both Ericsson units held daily team meetings (see Figure 5.5). The format of the dailies varied depending on team office presence, alternating between in-person, remote, and hybrid. Teams adapted flexibly, using meeting rooms or desks when they were held at the office, and MS Teams for remote or hybrid dailies. The daily meetings lasted between 15 and 45 minutes, and were considered especially important on remote workdays for discussing blockers and progress. Most teams used cameras to enhance engagement during remote and hybrid dailies, though some opted out due to bandwidth issues or reliance on shared Jira boards.

Taken together, these results highlight three key findings about recurring meetings in hybrid work within agile software development. Firstly, meeting formats should match their intent, with in-person meetings preferred for collaborative and social activities like brainstorming, retrospectives, and onboarding, while remote formats worked well for large-

scale information sharing. Secondly, office attendance policies shaped meeting practices, with more flexible policies often leading to hybrid formats that supported inclusive and cross-site participation. Finally, the third key finding is that concentrating too many meetings on in-person office days can reduce opportunities for informal interactions and spontaneous collaboration, which are vital in agile environments.

6 Discussion

This dissertation has highlighted how the shift from remote to hybrid work has brought significant changes within agile software development environments, reshaping how teams collaborate, communicate, and organize their work. The research examines these changes by analyzing how organizational policies, team arrangements, workspaces, and recurring meetings have adapted in response to evolving needs. The findings reveal that hybrid work is not a uniform experience but varies significantly across organizations and teams. These variations have prompted new ways of thinking about organizational policies, team alignment, meeting formats, and the use of physical office space. In the following section, I present the key findings of this dissertation and the implications for practice, and discuss the limitations and validity of this study.

6.1 Key findings

In this dissertation, I have approached the question of "How has the shift from remote to hybrid work influenced companies and teams within agile software development environments since the Covid-19 pandemic?". The key findings of my dissertation are summarized below, aligned with the five research questions:

RQ1: To what extent has hybrid work in agile software development been studied, and what is the scope and distribution of existing literature across geographical regions and research perspectives? The systematic mapping study identified only 12 relevant studies, indicating that hybrid work in agile software development remains under-researched. The research also revealed a geographic concentration in European, and particularly Nordic regions. Most studies focus on process-related aspects, with less attention given to people perspectives and none to a product perspective.

RQ2: How have the organizational policies of agile companies regarding hybrid work evolved during and after the Covid-19 pandemic? The research showed that the organizational policies for hybrid work were more nuanced than expected, both prior to and during the pandemic. Post-pandemic, flexible hybrid work policies and those based on predetermined schedules for either office presence or in-person events were the most prevalent.

RQ3: How can the hybrid work arrangements of agile software teams be characterized, and how have these arrangements evolved during and after the Covid-19 pandemic? A multidimensional model and team typology were developed to characterize the hybrid work arrangements of software teams, providing a nuanced and granular vocabulary for describing their configurations. The model distinguishes between hybrid, partially aligned, and variegated teams, based on work location, schedule, and alignment, and characterizes the teams according to their geographical distribution. The research illustrates a clear evolution in agile team work arrangements. It shows an early and unique instance of aligned location alternation, followed by a transition to diverse post-pandemic location

modes shaped by both team-level and organizational decisions. Teams also adapted their work hours, with over half adopting partially aligned schedules post-pandemic.

RQ4: How do free seating and check-in systems affect the workspaces of agile software teams in hybrid work? The shift to remote work during the pandemic, and consequent shifts to hybrid work post-pandemic prompted changes in office design and seating systems. While free seating and check-in systems, like hot desking, can support space efficiency, they can also hinder team cohesion and collaboration if not aligned with team distribution and office attendance patterns.

RQ5: How are recurring meetings organized for and influenced by hybrid work in agile software development? The format of recurring meetings in hybrid work is best determined by their intent. In-person meetings were preferred for brainstorming, active discussions, and to promote social bonding. Remote formats worked well for sharing information via presentations. Office attendance policies influence how meetings are organized, with more flexible policies leading to hybrid meeting formats that support inclusivity and cross-site collaboration. Concentrating too many meetings on office days can limit informal interactions and spontaneous discussions.

Next, I explore each of these findings in separate subsections. I also discuss the implications for practice, the threats to validity, and limitations of the research.

6.1.1 Hybrid work in agile environments remains under-researched

The results from the systematic mapping (Publication II) show that research on hybrid work within agile software development environments is on the rise, especially after the Covid-19 pandemic, with ten of the reviewed studies published in 2022 and 2023. Indeed, several more studies on the topic have been published after the mapping was conducted, such as Tkalich, Moe, et al., 2023; Liu, Stray, and Sporsem, 2023; Molléri and Mohagheghi, 2024; Stray and Barbala, 2024; S. Lisboa de Andrade et al., 2024; Šmite, Tkalich, et al., 2025; Stray, Moe, and Semsøy, 2025; Zaidman, Van-Dijk, et al., 2025; Zaidman and Van Dijk, 2025, which is further indicative of the rising trend. However, the number of studies included in the mapping—only twelve—was lower than anticipated.

One possible explanation for the low number of identified studies, is that hybrid work was not a widespread practice prior to 2020, and only gained prominence as a result of the pandemic. A large amount of empirical research on agile software development focused on remote work (e.g., Neumann, Bogdanov, Lier, et al., 2021; Qatanani, Qusef, et al., 2021), rather than on hybrid work, as remote work was the primary industry practice during the pandemic, due to the widespread lock-downs and restrictions. Consequently, there does appear to be a limited number of studies published about hybrid work specifically. This may also be attributed to the inherent delay in the academic research process, which involves the time-consuming stages of conceptualization, design, data collection,

analysis, and publication. In addition, the low number of studies could possibly be due to the search strategy and screening process used in the mapping. This limitation is further discussed in Section 6.3.3.

However, many companies have initiated internal investigations to address the challenges of hybrid work, as they seek practical solutions to adapt to the evolving work environment (e.g., Houck et al., 2023). It is expected that the trend will keep increasing, as more software companies speculate and experiment with hybrid work. Therefore, a key finding of the systematic mapping is that hybrid work in the context of agile software development remains under-researched. There is a clear need for more empirical studies to inform and support software engineering organizations currently navigating the complexities of hybrid work.

6.1.2 Research is concentrated in European and particularly Nordic regions

The second key finding of the mapping was the fact that the reviewed studies mainly investigated European organizations, while only one study came from outside Europe, from the USA. Moreover, half of the studied organizations were located in the Nordics, with three located in Norway specifically. Therefore, this topic appears to be of particular interest to European organizations and researchers, especially those in the Nordic countries.

Considering the previously mentioned limitations of the mapping, which are further discussed in Section 6.3.3, it is possible that more studies that took place in organizations outside of Europe were published prior to September 2023, but were not captured in the mapping. However, of the nine previously mentioned studies on the topic, which were published after the mapping was conducted, six investigate organizations located in Norway (Tkalich, Moe, et al., 2023; Liu, Stray, and Sporsem, 2023; Molléri and Mohagheghi, 2024; Stray and Barbala, 2024; Šmite, Tkalich, et al., 2025; Stray, Moe, and Semsøy, 2025), while two studied the same organization in Israel (Zaidman, Van-Dijk, et al., 2025; Zaidman and Van Dijk, 2025), and one investigated an organization in Brazil (S. Lisboa de Andrade et al., 2024). This further indicates that the Nordic countries are dominating the trend in this research area.

One possible explanation is that soon after the pandemic, several large companies outside of Europe, especially in Asia (Yu, 2023) and the USA (Nicholas and Hull, 2022; Elias, 2023), began mandating a return to the office, so organizations and researchers may have been less focused on hybrid work in those parts of the world. Whereas in Europe, hybrid work become more firmly established in the working lives of many employees post-pandemic (Demetriades, Cabrita, and Eiffe, 2023), and designing a positive future for hybrid work was therefore considered an important area of investigation in research. Nevertheless, hybrid work continues to persist as a global phenomenon, despite surges in return to office policies (Hays, 2025). To better understand important topics such as communication, fairness and inclusion, and operational efficiency, further research on hybrid

work in agile organizations across more diverse geographical regions would be beneficial.

6.1.3 Research on hybrid work has a strong focus on the process perspective

The synthesis of research questions in the 12 reviewed studies revealed a strong focus on the process perspective of hybrid work, while fewer studies focus on the people perspective. This is particularly noteworthy, given that the studies investigate organizations and teams that use agile software development, where a core value is to prioritize *"individuals and interactions over processes and tools"* (K. Beck et al., 2001). This imbalance suggests a potential research gap on the topic of hybrid work in agile software development. Future research could address this by examining the people perspective, for instance, at the organizational level, by exploring how organizational factors shape hybrid work practices.

In addition, none of the reviewed studies examined the product perspective of hybrid work. While Paasivaara and X. Wang (2022) note that it is unclear how hybrid work could be studied from this perspective, or whether this perspective is relevant, the potential impact of hybrid work on the product itself presents an intriguing avenue for future research. For instance, future research could explore how hybrid work influences end user involvement and the effectiveness of feedback loops.

Agile methodologies emphasize continuous customer collaboration and rapid feedback to ensure that the product evolves in alignment with user needs. However, hybrid work may limit direct access to end users due to physical separation. Without opportunities for direct user observation or co-design sessions, usability issues might go unnoticed, and feedback loops could become fragmented or delayed. Understanding how hybrid work affects these dynamics is crucial for maintaining the agility and responsiveness of product development.

6.1.4 Previous organizational policies were more nuanced than expected

The research in Publication III showed that despite traditional *office* policies typically being considered the norm prior to the pandemic, the organizational policies were more nuanced than expected, as five of the investigated companies permitted employees to work from home on occasion. So, multiple early instances of the hybrid work policy *office-first* were already implemented prior to the forced work from home situation triggered by the pandemic. The direct shift to *remote* work policies, which was observed in four of the companies and instigated by the pandemic restrictions, took place across the entire IT sector, as is observed in numerous studies, for example, Moe, Stray, et al. (2023), Masood, Damian, and Blincoe (2021), Ågren, Knoph, and Berntsson Svensson (2022), and Souza Santos and Ralph (2022).

In contrast with this direct shift, two companies (Delta and Echo) combined *remote* work

with an *event-triggered* policy, allowing a small number of employees to work from the office during certain periods or upon agreement with their managers. Both of those implementations of the *event-triggered* policy have distinct similarities to the hybrid work policy discussed by Smith et al. (2023), where limited personnel were allowed and required to be physically present at the office during the pandemic, based on rules for social distancing and room capacity. Additionally, prior to that shift, Echo experimented with a *fixed* policy, where all employees were required to alternate working from home every other week. These insights reveal that hybrid work policies were more varied and context sensitive than previously assumed. They offer a more detailed understanding of how such policies were implemented prior to the pandemic, and how they evolved during the pandemic, contributing valuable empirical insights into the practical realities of hybrid work in agile software development.

6.1.5 Flexible and calendar-based policies were most prevalent post-pandemic

The post-pandemic prevalence of *flexible* policies for hybrid work, which was identified in the organizations investigated in Publication III, Publication IV, and Publication V, is also widespread in related studies exploring hybrid work in agile software development. For instance, in the eight companies investigated by Souza Santos, Adisaputri, and Ralph (2023), and the three companies investigated by Neumann, Habibpour, et al. (2022), Kemell and Saarikallio (2023), and de Andrade et al. (2024) respectively, employees can decide individually if they want to work from home or from the office.

Similarly, the *semi-fixed* policy, which was identified in three organizations investigated in this dissertation, is also reported in four related studies (Moe, Stray, et al., 2023; Šmite and Moe, 2022; Šmite, Moe, Tkalich, et al., 2022; Bablo, Marcinkowski, and Przybylek, 2023). For example, one of the Norwegian organizations investigated by Šmite, Moe, Tkalich, et al. (2022) implemented a *semi-fixed* policy where the developers specifically can spend two days at home and three days at the office, which can be further adjusted upon agreement with their team, work unit, manager, or the customer.

The *fixed* organizational policy identified in Ericsson (Unit 1), where employees are expected to work at the office every Tuesday and Thursday, is similar to the policy discussed by Z. Wang et al. (2022). In the Californian company, Mondays, Tuesdays, and Fridays are designated office days for the employees, while Wednesdays and Thursdays are designated remote days for focused standalone work sessions (Z. Wang et al., 2022). The *event-driven* policy identified in Kempower is similar to one example described by Jackson et al. (2022), of a company that supports remote work, yet recognizes the importance of in-person events, so they organize these events three times a year for their software teams.

As shown in both the results of this dissertation and in the aforementioned related studies, multiple hybrid work policies rely on what Conboy et al. (2023) describe as a ‘calendar-

based approach', where office and in-person work is based on predetermined schedules. However, Conboy et al. (2023) recommend an alternative approach, i.e., to organize in-person work at the office around specific events rather than fixed times, which is in line with the policy I have labeled as *event-triggered*.

As discussed by Conboy et al. (2023), software development often follows an event-based pattern, where work is shaped by incidents such as system failures, evolving customer needs, or new team members joining. It may therefore be more effective to structure hybrid work around key events and encourage or require in-person collaboration when certain events happen, rather than sticking to rigid time-based policies. However, only one instance of the *event-triggered* policy was identified post-pandemic (in Alfa), in the companies investigated in this dissertation.

Given the limited implementation of the *event-triggered* policy post-pandemic and the practical reasoning discussed by Conboy et al. (2023) for its recommendation, more companies may benefit from experimenting with a similar implementation. Additionally, while Conboy et al. (2023) present their recommendations within the broader context of software engineering, the agile value of *"responding to change over following a plan"* (K. Beck et al., 2001) underscores the relevance of this recommendation to agile software development, as this approach may offer greater adaptability and alignment with team needs and project demands.

6.1.6 A nuanced characterization of software team work arrangements

The team typology and model of work arrangements for software teams created in Publication I, and further expanded in Publication III contributes to the debate of what to expect in the future workplace, by providing a new vocabulary for team work arrangements that goes beyond simply describing the work location of employees, but characterizes team alignment in the work location and schedule, as well as their geographical location.

Immediately after the Covid-19 pandemic, there was much debate around the future of work, as companies and teams began shifting from the forced work from home scenario, to new forms of hybrid work (Šmite, Moe, Klotins, et al., 2023). While some models were designed to help companies, and managers in particular, conceptualize and consider the shift in work trends (e.g., Setty, 2021; Gratton, 2021), they often emphasized the shift from traditional office norms to more flexible arrangements, and were ideal for illustrating broader shifts in work culture and guiding policy decisions.

In contrast, the model proposed in this dissertation (Figure 5.3) is more nuanced and granular. It focuses on the level of alignment between team members, illustrating the wide spectrum of hybrid work arrangements software teams may adopt, and is therefore useful for helping organizations to understand the diversity of hybrid setups and their implications for scheduling and collaboration.

6.1.7 Early location experimentation, post-pandemic location diversification, and core hour scheduling in agile team work arrangements

The first key finding regarding the work arrangements of agile teams is that while most teams worked fully *remote* during the pandemic, the teams in Echo uniquely began alternating between work from the office and work from home early on, following the company policy of alternating their work location every other week. Although prior studies provide some descriptions of instances where a few employees, such as those with critical functions, still worked from the office during the pandemic (e.g., Smith et al., 2023), the experimentation in Echo stands out as it was uniformly adopted across all teams, and is the earliest example of variegated teams, i.e., teams whose members are fully aligned in their office attendance.

This stands in contrast to related studies, such as Sporsem and Moe (2022), where similar instances of experimentation with aligned and partially aligned team work arrangements took place during the later stages of the pandemic when restrictions began lifting and offices were reopened with limited presence, room occupancy, or specific clauses for social distancing.

The second key finding is that agile teams transitioned into a wide range of work location modes post-pandemic. These modes ranged from fully *flexible location* arrangements, to more aligned ones, such as *semi-remote* and *aligned office-remote mix* modes. This evolution was either initiated by team members themselves and supported by flexible company policies, or was driven by top-down experimentation at the organizational level. In both scenarios, most teams moved away from traditional *office* or fully *remote* modes, enabling the development of more fluid and adaptive team arrangements.

Some related studies, for instance, Molléri and Mohagheghi (2024) and Liu, Stray, and Sporsem (2023), discuss experimentation with team work arrangements post-pandemic, broadly speaking, in connection with other topics related to hybrid work in agile software development. However, very few studies focus explicitly on team work location arrangements and provide detailed and nuanced accounts of how they have recently evolved, such as Z. Wang et al. (2022) and Bablo, Marcinkowski, and Przybylek (2023).

In contrast with the limited experimentation regarding the work location arrangements of the agile teams during the pandemic, the third key finding shows how work hours were more varied, with multiple instances of partially and fully aligned schedules, in addition to fully flexible and synchronous ones. This trend continued post-pandemic with one additional work arrangement emerging, i.e., *core meeting* mode. Prior research on hybrid work has often emphasized location over schedule, so there is little empirical evidence of how agile teams have adapted their work schedules in literature on the topic.

The most prevalent work schedule arrangement identified post-pandemic in this disser-

tation is the partially aligned *core hours* mode, which is also reported in the few studies that discuss the scheduling of agile teams. For example, in one Norwegian agile company (Molléri and Mohagheghi, 2024), employees are expected to work during core hours (i.e., 9:00 to 14:30) to allow a synchronization window. The implementation of core hours at the company policy level is also reported by Z. Wang et al. (2022), but the exact time frame and the adoption of the work mode at the team level are not described in the study.

Together, these findings contribute to the growing body of knowledge on hybrid work in agile software development. They offer a detailed and empirically grounded account of how location arrangements uniquely evolved during the pandemic in some teams, while most teams diversified their locations post-pandemic. In some cases this evolution was driven by the teams, while in others the organizational policies shaped the team decisions. The findings also highlight how work hours adapted over time, with more than half of the investigated teams adopting partially aligned schedules in the post-pandemic period. This addresses a gap in the existing literature, which has largely overlooked the nuanced development of these configurations.

6.1.8 Effective seating systems hinge on team distribution and office co-presence

Hot desking has been proposed as one practical solution to address the issue of underused office spaces in hybrid work settings (Šmite, Moe, Tkalich, et al., 2022), and the results of Publication V support this approach. In growing companies like Kempower, where employees are spread across multiple locations and few are present in the same office simultaneously, the implemented free seating system proved effective in enabling an adaptable and resourceful allocation of the available desks.

However, as the results of Publication III, Publication IV, and Publication V show, free seating systems can also undermine focused teamwork and create discomfort due to unclear boundaries in shared workspaces. Close collaboration, which can be enabled by fixed team workspaces, is often essential for agile teamwork, and is especially important for teams who are often copresent at the office. This insight is supported by Moe, Stray, et al. (2023), who found that employees preferred fixed team zones because they gave each team a dedicated home zone.

The key finding is therefore, that while free seating systems like hot desking can be a practical solution for managing office workspaces in hybrid work, its effectiveness depends heavily on team distribution and office attendance patterns. With increasingly fluid team arrangements and ongoing company experimentation with seating systems, the requirements for effective team workspaces are neither well defined nor well understood, making it crucial to align workspace systems and policies with actual team needs. Agile teams, in particular, may benefit from more tailored workspace systems and policies that preserve team cohesion and support their collaborative practices, so policy makers should consider this when planning and designing seating systems and policies for hybrid work.

6.1.9 The format of meetings in hybrid work should align with the intent

The key finding from this dissertation regarding recurring meetings is that the format should align with the intent, i.e., the aim and purpose. The results of Publication IV and Publication V show that meetings involving active discussion or brainstorming, such as retrospectives, are best held in-person. This insight is also discussed in related studies. For instance, Tkalich, Šmite, et al. (2022) found that in-person meetings facilitate a more dynamic and spontaneous exchange of opinions, compared to online attendance in remote and hybrid meetings.

Likewise, meetings such as the unit day events and the information sharing meeting in Unit 1 in Ericsson, where social activities and integration of new colleagues are in focus, were found to be best suited for an in-person format. The importance of creating opportunities for newly onboarded employees to meet with their colleagues in-person is also discussed in related studies of hybrid work in agile software development. For example, Stray, Moe, and Semsøy (2025) found that being physically present in meetings was crucial for newly onboarded developers, who had numerous questions, and were hesitant to spam their colleagues via MS Teams when joining online meetings. Similarly, Tkalich, Šmite, et al. (2022) found that in hybrid work new hires needed time to get to know their team members and strengthen their social bonds, and that this could be achieved through social activities and informal coffee talks.

Additionally, the results show that meetings which are primarily intended to share information via presentations, like the sprint review, work well when all attendees are remote. Sporsem, Strand, and Hanssen (2022) similarly observed that large status-reporting meetings were ideally scheduled on remote work days. The virtual format of remote meetings can enhance participation for large audiences, by offering good visibility of the content with a clear voice, and ensures an equal experience for all attendees.

6.1.10 Policies shape meeting formats and space for informal discussion is essential

While some recurring meetings, like the team sprint planning in Unit 1, were held occasionally in a hybrid format to ensure the attendance of team members who could not be present in-person, only a few meetings were consistently planned this way. At the unit level, hybrid meetings were held exclusively in Unit 2 at Ericsson and at Kempower. Unlike Unit 1 at Ericsson, which followed a *fixed* office day policy allowing meetings to be scheduled as either fully in-person or remote, Unit 2 and Kempower operated without fixed office days. Consequently, the various community meetings, and information sharing meeting in Unit 2, were all held in a hybrid format to allow for flexible participation and support cross-site collaboration. This contrast highlights how different organizational policies regarding office attendance can directly influence the format of recurring meetings in hybrid work, with more flexible policies necessitating hybrid meetings to accommodate diverse participation needs.

Finally, it may seem efficient to schedule most recurring meetings on days when employees are expected to be in the office, especially considering the interactive nature of agile meetings. For instance, Masood, Damian, and Blincoe (2021) recommend scheduling agile ceremonies on days when team members are physically present at the office. However, insights from participants at Ericsson (Unit 1) emphasize the importance of leaving room for informal conversations. This is particularly relevant for specialists, whose schedules are often filled with meetings but who still need to be available for spontaneous discussions with colleagues. Alternating between in-person and remote meetings within those communities proved to be a useful strategy. This insight aligns with findings of Z. Wang et al. (2022) and Sporsem and Moe (2022), who also highlight the importance of preserving space for spontaneous interactions in hybrid work.

6.2 Implications for practice

Based on the findings presented in the dissertation, several practical implications emerge for organizations and practitioners navigating hybrid work in agile software development environments. These recommendations aim to support more effective collaboration, team cohesion, and adaptability in the evolving post-pandemic workplace.

Organizational policies for hybrid work should be context-sensitive. Post-pandemic trends show a shift toward calendar-based approaches and flexible office attendance policies that allow employees to choose their work location based on personal preferences. However, event-triggered policies, where in-person work and office attendance is organized around specific events such as onboarding or project milestones, may offer greater alignment with agile values of responsiveness and adaptability. Practitioners are encouraged to experiment with such approaches to better support team dynamics and project demands.

Hybrid work arrangements vary widely across teams and organizations. A nuanced understanding of team configurations, including alignment in work location and schedules, and geographical distribution, is essential for effective collaboration. The typology developed in this research provides a vocabulary for describing these arrangements and can help managers tailor support and coordination strategies to specific team contexts.

Office seating systems must be aligned with team distribution and patterns of co-presence. While free seating arrangements like hot desking can improve space efficiency, they may undermine team cohesion if not tailored to the needs of agile teams. Fixed team zones or dedicated workspaces can foster stronger collaboration and improve communication, especially for teams that frequently work together in-person. Organizations should consider the nature of team interactions when designing office layouts and seating systems and policies.

Finally, meeting formats should be intentionally designed to match their aim and purpose. Collaborative sessions such as retrospectives and onboarding activities are best

conducted in-person, as they benefit from dynamic interaction and contribute to social bonding. Conversely, remote formats are more suitable for large-scale information sharing meetings, especially presentations, where clarity and equal participation are essential. Practitioners should avoid scheduling all meetings on designated office days, as this can reduce opportunities for informal conversations and spontaneous collaboration, which are vital in agile environments. This is particularly important for employees like specialists, who need to be available for ad hoc discussions with agile team members when at the office. By fostering environments that support both structured and informal communication, practitioners can maintain agility and cohesion in hybrid work settings.

Together, these implications underscore the importance of thoughtful considerations and continuous adaptation in hybrid work within agile contexts. Organizations that align their policies, practices, and work environments with the evolving needs of their teams are better positioned to sustain effective collaboration and cohesion in a post-pandemic world.

6.3 Validity and limitations

In the following, I first discuss the steps taken to mitigate the threats to the validity in this dissertation following the classification schemes by Yin (2018) and Petersen, Vakkalanka, and Kuzniarz (2015). I then discuss the threats that could not be mitigated and limitations of the research.

6.3.1 Case study validity

In this section I describe the threats validity of Publication I, Publication III, Publication IV, and Publication V, following the validity types for case study research (Yin, 2018). Although Publication I was not designed as a case study, its validity aspects are reported in connection with the case studies, as the empirical insights, which showcased archetypes of the defined work arrangements, were approached as six industrial cases. Additionally, the case studies in this dissertation are exploratory and do not examine causal relationships (Yin, 2018), therefore, that aspect of validity is not discussed.

Construct validity: To ensure construct validity in the case studies, several steps were taken throughout the research process. Comprehensive interview guides were designed with open-ended questions, that encouraged participants to share their experiences freely, without being led toward specific responses. To capture a diverse range of hybrid work settings, companies of different sizes and from various industry sectors were selected. All participants in the case studies were experienced in agile software development and hybrid work, which helped minimize the risk of misinterpretation or differing understandings of key concepts between the researchers and the participants. To further strengthen construct validity, feedback sessions and follow-up communications were conducted with participants to verify the interpretations, clarify missing details, and ensure consistency across cases. Drafts of the findings were shared with company representatives for valida-

tion, and their feedback confirmed the accuracy of the results, with the exception of one participant who declined follow-up contact.

External validity: Although the primary aim of the studies was to explore the evolution of hybrid work practices rather than to produce generalizable results, several measures were taken to support the transferability and analytical generalization of the findings. Cases were selected to reflect diversity in company size, industry sector, and organizational settings, particularly within agile software development environments adopting hybrid work models. Participants represented a range of roles with varied levels of experience with agile, which helped broaden the perspectives included, and reduce role-specific bias. While the number of interviewees was relatively small compared to the total number of teams studied, particularly in Publication III, detailed case descriptions were provided to support contextual understanding, and enable readers to assess relevance to similar settings. The findings are considered analytically generalizable to companies operating in similar cultural and geographic contexts, especially within the Nordic region.

Reliability: To enhance the reliability of the studies, multiple measures were implemented throughout the research process. Interview protocols were used to ensure consistency across all interviews and were made publicly available to support transparency and replication. The coding processes were conducted iteratively and collaboratively, with regular meetings held among two or more researchers in each study to discuss and refine the codebook. This approach helped reduce the risk of single-researcher bias and promoted shared understanding of the data. The codebooks were also made publicly accessible, including detailed descriptions of all coding levels. This supports the possibility of reproducing a similar coding structure by other researchers. In addition, the involvement of multiple researchers in both data collection and analysis contributed to consistency and reduced subjectivity.

6.3.2 Systematic mapping study validity

In this section I describe the threats validity of Publication I, following the validity types for systematic mapping studies (Petersen, Vakkalanka, and Kuzniarz, 2015).

Descriptive validity: To ensure accurate and objective recording of observations, a structured data extraction form was used. This form supported consistent documentation of extracted data and allowed for revisiting and verification throughout the study.

Theoretical validity: Several measures were taken to mitigate biases and ensure that the study captured what it intended to. Potential selection bias was addressed by involving four of the five authors in finalizing the inclusion and exclusion criteria, in accordance with established guidelines (Petersen, Vakkalanka, and Kuzniarz, 2015). To reduce search strategy bias, multiple synonyms for the three main keywords were considered, and grouped into sets. Pilot searches were conducted using various combinations of these sets

before finalizing the search string. Additionally, backward and forward snowballing was performed on selected and key papers to identify potentially missed studies, especially those not captured due to the search being limited to titles, abstracts, and keywords.

Generalizability: The generalizability of the findings is constrained by the limited number of identified studies, which may not fully represent the breadth of the research area. Furthermore, restricting database searches to metadata fields and excluding studies focused primarily on remote work may have led to the omission of relevant literature, thereby limiting the generalizability of the systematic mapping study's findings. These limitations are further elaborated in Section 6.3.3, and suggest that the results may be more indicative than exhaustive.

Interpretive validity: Interpretive validity was supported by collaborative review, and consensus among the authors during study selection and data extraction. However, the potential for researcher bias in interpreting the data remains, especially given the subjective nature of mapping classifications.

6.3.3 Limitations

While efforts were made to enhance the validity of the publications included in this dissertation, certain limitations remain, particularly in regard to the generalizability of the results and findings, which I describe in this section.

In the systematic mapping study (Publication II), several constraints in the search strategy and screening process may have affected the comprehensiveness and generalizability of the findings, rendering them more indicative than exhaustive. Specifically, the relatively small number of studies identified may be partly attributed to search strategy employed. This limitation was identified after the mapping had been completed and reported, during preparations for a forthcoming systematic literature review on hybrid work in agile software engineering (Khanna, Christensen, Broomandi, et al., 2025), which is not part of this dissertation.

Pilot searches for the forthcoming systematic literature review revealed that restricting database queries to metadata fields (title, abstract, keywords) caused the agile keyword string to significantly narrow the search results. For example, four of the studies from Publication II that had been identified via snowballing (S6–S8, S12) were available in IEEE Xplore, but these studies did not show up in the database search results when the search fields were set to 'all metadata', because they only mentioned agile terms in the full text.

In addition, the screening process employed in Publication II limited the results to studies that focused specifically on hybrid work settings, so studies that focused primarily on remote work settings were excluded (e.g., Moe, Stray, et al., 2023). Several other studies

which report some instances of hybrid work in agile contexts were also identified in the pilot searches of Khanna, Christensen, Broomandi, et al. (2025), such as Masood, Damian, and Blincoe (2021) and Ågren, Knoph, and Berntsson Svensson (2022), but were not retrieved through the database searches in Publication II. This was likely due to the specific search fields or keywords used. However, similar to Moe, Stray, et al. (2023), these studies focus primarily on remote work, so would not have met the criteria for inclusion in the mapping.

In the case studies, the geographic concentration of companies and participants in the Nordic region may constrain the applicability of the findings to other regions or organizational cultures. Agile practices can be directly shaped by organizational norms and cultures (Šmite, Moe, and Gonzalez-Huerta, 2021), and the adoption of hybrid work may similarly be influenced by technological infrastructure, labor policies, and cultural attitudes toward collaboration and flexibility. As such, the insights derived from Nordic companies, where work-life balance and digital readiness are typically high, may not fully translate to contexts with different socio-economic conditions or organizational structures.

The use of convenience sampling in the case studies, i.e., selecting companies from the researchers' existing networks, may have introduced selection bias (Baltes and Ralph, 2022), as the selected organizations were already engaged with and interested in hybrid work, and may be more likely to have progressive, experimental, or well-resourced practices, which may have skewed the findings toward more favorable or advanced implementations. The findings may therefore not be generalizable to organizations and agile teams with less extensive experience in hybrid work practices.

Another limitation of the case studies is that most interviews were conducted via video calls in Zoom and Microsoft Teams, rather than in-person. While virtual interviews enabled access to geographically dispersed participants, they may have affected the depth and quality of the data collected. Building rapport and trust can be more challenging online, potentially limiting how openly participants share their experiences (Archibald et al., 2019). Additionally, the inability to fully observe non-verbal cues can limit researchers' ability to interpret responses in context, while a lack of spontaneous interaction can potentially also force interviewers to take a more directive role, which may affect the authenticity of responses (Lobe, Morgan, and Hoffman, 2022). Similarly, the recurring meetings investigated in Publication IV and Publication V were explored solely through interviews, without direct observation of actual meetings. This may have limited the findings, as interactional dynamics that shape behavior in meetings may have been overlooked, given that interviews can sometimes lead researchers to overemphasize individual-level narratives (Lamont and Swidler, 2014). These factors together may have shaped the nature and richness of the data gathered through the interviews.

7 Conclusions

This research set out to investigate how the shift from remote to hybrid work has influenced companies and teams within agile software development environments since the Covid-19 pandemic. My research was guided by five questions, each addressing a distinct aspect of this evolution, which I approached through a combination of conceptual modeling, a systematic mapping study, and three exploratory case studies. In this chapter, I present a summary of my research contributions and discuss directions for future research.

7.1 Summary of the research contributions

This dissertation makes several significant contributions to the field of agile software development, in the context of hybrid work. In terms of literature contribution, the dissertation identifies critical gaps in the existing body of knowledge on hybrid work in agile software development. The systematic mapping study reveals that while hybrid work is on the rise, the topic is under-researched, with limited empirical studies, most of which were carried out in Europe, and Nordic countries in particular, and a primary focus on process-related aspects. By addressing these gaps, the dissertation lays the groundwork for future investigations and encourages a broader exploration of hybrid work from people and product perspectives, and across more diverse regional contexts. It also provides a curated overview of existing research, serving as a valuable resource for researchers and practitioners alike.

From a conceptual point of view, the research introduces a novel team typology and a multidimensional model for hybrid work arrangements of software development teams. This model goes beyond traditional binary classifications of remote and office work by incorporating dimensions of work location, schedule, and alignment among team members. It enables a more precise and nuanced analysis of team configurations, offering a vocabulary that reflects the complexity of post-pandemic software development. The typology has proven effective in characterizing the diverse arrangements of agile software teams observed in the case studies and provides a foundation for future research and organizational decision-making.

Empirically, the dissertation offers rich qualitative insights derived from ten companies and 48 agile teams. These insights document the evolution of hybrid work policies and team work arrangements during and after the Covid-19 pandemic. The nature of the case studies captures the dynamic shifts in organizational policies and team work arrangements, revealing that organizational policies were previously more nuanced than expected, with a shift toward flexible and calendar-based policies post-pandemic. It presents an early and distinctive example of aligned location alternation in the agile teams, followed by a shift to varied post-pandemic work location arrangements influenced by both team-level and organizational decisions. It also shows how the teams adjusted their sched-

ules, with more than half adopting partially aligned schedules after the pandemic.

Finally, the dissertation offers guidance for agile software development practitioners navigating hybrid work environments. It emphasizes the value of event-triggered hybrid work policies, such as organizing in-person attendance around onboarding or project milestones, rather than calendar-based approaches. The insights also highlight the impact of free seating and check-in systems, showing that while they can support office space efficiency, they can also hinder collaboration if not aligned with team office attendance and distribution. The dissertation also shows how selecting the format of recurring meetings based on intent can be beneficial, such as using remote formats for sharing information via presentations, in-person for brainstorming, active discussions, and to promote social bonding, and hybrid for accommodating diverse participation needs, particularly for agile teams who are not often co-present at the office. Finally, to preserve room for informal interactions and spontaneous collaboration, which are essential for agile teams, it might be helpful to avoid concentrating all meetings solely on office days.

7.2 Future research directions

Building on the findings and limitations of this study, several directions for future research are proposed. First, there is a need to explore hybrid work in agile software development across diverse cultural and regional contexts, particularly outside of the Nordic countries. Understanding how cultural norms and regional infrastructure shape policies and collaboration in hybrid work can offer broader insights.

Second, future studies should examine both people- and product-related perspectives of hybrid work in agile software development. This includes investigating how organizational factors shape hybrid work practices, as well as the influence of hybrid work on product quality and feedback loops from customers. These dimensions are critical for assessing the broader factors that influence hybrid work, how hybrid work is carried out, and its impact. Moreover, there is limited research on how agile teams have structured and aligned their schedules post-pandemic, so future research would benefit from exploring this topic.

Third, future research should investigate how organizational workspace policies, such as hot-desking and free seating, impact the effectiveness of agile software teams. Specifically, studies should examine what constitutes a functional team workspace and how teams interact with and adapt to the physical office work environment. Finally, longitudinal research could reveal how hybrid work in agile software development evolves over time, especially as companies and teams continue to experiment and refine their approaches and practices.

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Publication I

Šmite, D., Christensen, E. L., Tell, P., and Russo, D.
The Future Workplace: Characterizing the Spectrum of Hybrid Work Arrangements for Software Teams

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The Future Workplace

Characterizing the Spectrum of Hybrid Work Arrangements for Software Teams

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// This article systemizes a spectrum of emerging work arrangements for teams, including hybrid teams, partially aligned teams and, more importantly, variegated teams with fully aligned alternation of office presence. Our team typology is based on the practical insights from "Alpha," "InterSoft," Valtech, IBM, Brandwatch, and Ericsson. //

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DURING THE COVID-19 pandemic, we learned that many preconceptions about remote work were misplaced, and developers adapted to the emerging situation reasonably quickly,[1,2] with their daily work lives not particularly disrupted.[3] Such better-than-expected forced working from home (WFH) experiences, coupled with the investments enabling remote work during the pandemic, led many knowledge workers to rethink their return to the offices.[4] The interest in working remotely from home or in an alternative working space like a café has become mainstream. Employees started to express their wish to keep the job as they move to remote cities or even globally and leave if they are not permitted to work remotely.[4,5] In response to the new demands, many companies alter their work policies and experiment with new work arrangements that balance expectations from employees and management regarding where and when the work should be done.[4]

The word "hybrid" has become one popular umbrella label attributed to various work-related terms. These days, we often read about hybrid workplaces or hybrid offices,[6] hybrid work or working,[7,8] as well as hybrid teams.[9] Google Workspace experts define *hybrid work* as *"a spectrum of flexible work arrangements in which an employee's work location and/or hours are not strictly standardized."*[7] In other words, anything that lies in the middle of "in the office, nine till five" and "anywhere around the world at any time."[7] However, one should be careful in using the word *hybrid* to describe individual choices or team arrangements. If someone is free to decide when and where to work, it does not mean that the chosen work

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arrangement will be hybrid. Studies show that, despite the introduction of hybrid work policies, at least some employees in every company prefer to return to the office full-time.[5] So, what does "hybrid" mean for individual work arrangements, and especially for teams?

An early occurrence of the word *hybrid* with corporate work appeared long before the pandemic. *Hybrid workspaces* emerged from the interest in homeworking motivated by increased commuting distances and time, as well as virtual working motivated by the pressures on office costs and space, growth in the use of hot-desking, and contemporary architectural trends;[10] somewhat similar reasons to those driving employees toward continuing WFH today.[11] Halford suggests defining the "multiply located" workspaces as hybrid workspaces. *Hybrid work* is also used to refer to distributed teams consisting of colocated and remote members in the context of global software development and outsourcing.[8]

Even today, the use of "hybrid" work arrangements varies. For example, Fayard et al. attribute *hybrid* to the office and define *working in the hybrid office* as the practice of "moving between a home workspace and a traditional office building."[6] In contrast, Google Workspace experts define hybrid work in relation to restrictions imposed on the work location and/or hours.[7] The latter adds the time perspective to Halford's proposal,[11] echoed by a few others.[12,13] The list of definitions of *hybrids* are contradictory and could continue.

Interested in achieving clarity in understanding the future work arrangements, we deconstructed the terminology related to the future workplace, and set the boundaries of hybrid work in the context of remote work[14] and "telework,"[15] which have been researched in decades.

In 1983, Olson defined remote work as *"organizational work performed outside of the normal organizational confines of space and time"* and focused on satellite and neighborhood work centers, flexible work arrangements, and work-at-home as remote work options.[14] In addition, Sullivan points out that the use of technologies, proportion of work time that is decentralized, and contractual arrangements (employed or self-employed) are important distinguishing dimensions.[15] In the context of software companies, the use of technology goes without saying, and we focus on contracted employees. Thus, we argue that the core dimensions relevant for understanding individual work arrangements in the future workplace are *location* (where the work is performed) that incorporates the degree of remote work, and *work schedule* (when the work is performed). To avoid confusion, we suggest using the following location options:

- office mode
- office-first—primarily in the office
- office-remote mix (flexible, "working from anywhere")
- remote-first—mostly offsite
- remote mode.

We intentionally use *office-first* and *remote-first* options instead of *hybrid* because a location cannot be simultaneously of two types. We, thus, suggest avoiding terms such as *hybrid office* and *hybrid workplace*. We use the word *remote* for any location other than the office. Other often used terms include WFH, work-from-anywhere (WFX or WFA), telecommuting, teleworking, homework, home office, mobile work, outwork, and the flexible workplace.[13] But what happens on the team level when individual work arrangements differ or do not match? In this article, we add another important dimension that distinguishes flexible work arrangements in the team context—the degree of alignment of the individual arrangements among the team members, presented in the next section.

Studies show that, despite the introduction of hybrid work policies, at least some employees in every company prefer to return to the office full-time.

Emerging Work Arrangements

In this article, we present team typology and multidimensional work arrangements (see Figure 1) emerging through the iterative process of inductive reasoning and derived from the aforementioned existing research and the six industrial cases presented

later. Our goal is to offer a vocabulary to avoid the confusion that seems to prevail in the current conversations about hybrid work arrangements. Ironically, similar confusion regarding the boundaries of the phenomenon prevails in telework research.[15]

The most traditional work arrangement until now has been "in the office, nine till five;" thus, on-site teams with aligned work schedules have prevailed. We are also familiar with the well-researched concept of virtual or remote teams, as often temporary formed expert teams with geographically dispersed members. Similarly, distributed teams have been commonplace in global and outsourcing projects as permanent multilocation teams with members working from different geographically distant offices of the same or different cooperating companies.[9] When individual work arrangements in the team differ, a spectrum of new work arrangements emerges along with the degree of alignment among the team members (see the *y*-axis in Figure 1).

Hybrid Teams

Hybrid teams are related to distributed teams, but instead of office locations, their members could WFH, a café, or anywhere else. These are Halford's teams consisting of "multiply-located" members working in the office and from home[10] and more recent hybrid teams described by Santos and Ralph as teams in which, on any given day, some team members may be working in a colocated office while others are working remotely.[9] We suggest distinguishing further between the degree of alignment of individual work arrangements in a team. Hybrid teams are never completely virtual, yet different hybrid teams can occupy different ranges of the virtuality spectrum.[16] We thus define hybrid teams with a fully flexible location mode having erratic office presence and additionally define partially aligned (or partially hybrid) teams.

Partially Aligned Teams

Partial alignment in teams can surface when not everybody's arrangements are aligned, or when members do not always align. For simplicity, we define three archetypical modes with members having an agreed intention to be working in a semiremote, office-remote mix or semi-on-site mode. In practice, these are clusters of team arrangements that span the spectrum between the fully flexible and aligned location modes.

Variegated Teams

Notably, flexible work policies do not always lead to erratic choices. Teams with aligned location decisions we call *variegated teams*. These teams have predefined but altering work locations with varying degrees of office presence. In other words, these are teams that change or variegate their

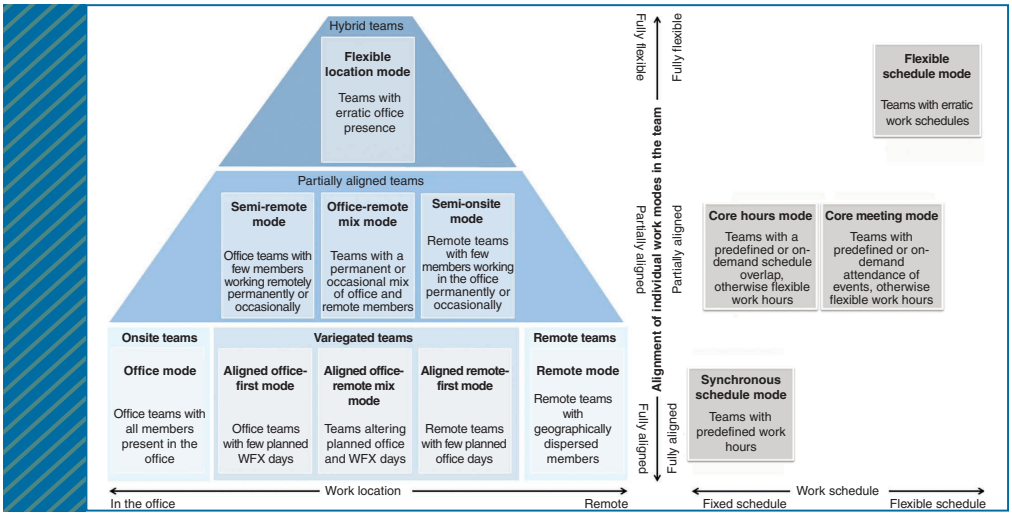

FIGURE 1. Team typology and the spectrum of work arrangements.

team's work arrangement between the office and remote locations. Because of these changing experiences, we chose to use the term *variegation*, which comes from botany. Variegated teams can have few aligned WFX days, which we call *office-first mode*, teams with a few aligned office days or on-demand occasions, which we associate with the *remote-first mode*, and teams with a fair mix of office and WFX days, which we associate with the *office-remote mix mode* because the variegation between the remote and office mode in these teams is fairly balanced. The main difference between hybrid teams and variegated teams is that the latter teams, on any given day, have a level playing field experience with either all team members working in colocation on site or all members working remotely.

Besides the location, a work arrangement also includes an agreement about the work schedule. These may differ based on personal preferences or different time zones. Teams may have the following options:

- *synchronous mode* with fully overlapping work hours, e.g., 9 a.m.–5 p.m.
- *flexible mode* with potentially erratic work schedules
- partially aligned work schedules:
  1. *core hours mode* with designed time overlaps, in which members choose a synchronization window and have otherwise flexible schedules, and
  2. *core meeting mode* organized around scheduled meetings or designed events, which members agree to attend planned meetings, gatherings, and events, but otherwise keeping work schedules flexible.

Choice of Work Arrangements

The choices of work arrangements can be influenced by various factors: management expectations, employee preferences, teammate agreements, nature of the work assignments and job roles, organizational policies, corporate culture,[5] and commute distances considering the growing environmental concerns (see Digital Nomads[17]). Companies enforce policies best suited for their corporate culture and traditionally had centralized regulations with one dominant work arrangement option as the common rule (e.g., synchronous office mode). Today, companies often choose to delegate work arrangement decisions to immediate managers or teams or leave the choice to every employee, allowing a fully flexible policy.[5]

Besides, work arrangements can change overnight in response to a societal emergency, such as government-enforced policies. The pandemic crisis has also demonstrated that companies with flexibility incorporated in their operation have successfully transitioned to the enforced full-time WFH,[2] linking organizational policy flexibility with increased organizational resilience to crisis.

Practical Insights

Following, we provide a selection of empirical insights showcasing the defined work arrangements and their evolution since the beginning of the pandemic. These are based on six semistructured interviews with team managers and team leads from six different companies ("Alpha," "InterSoft," Valtech, IBM, Brandwatch, and Ericsson).

Alpha (Pseudonym)

At Alpha, we met a team that, at the time of our study, was neither subject to corporate-level policies nor imposed a team-level agreement on where and when team members shall work, i.e., a *hybrid team* with erratic office presence and a *fully flexible schedule*. As one of the members explained: *"[…] Now it's like you work at random times sometimes. You get more and more loose. You don't start at 9:30; you might start late, you might finish late."*

We learned that this arrangement was not ideal because it made scheduling problematic as the work schedules of team members were unpredictable. To address this issue, the team considered aligning the work schedules to achieve a certain overlap. As the tech lead explains: *"So we [the leadership team] were talking about identifying […] a core time slot for the team. Like everybody has to be available from, I don't know, 10:30 to 3:00. Then the rest you'll handle how you like."* In other words, the team saw the need to partially align their schedules as the *core hours mode*.

> We are also familiar with the well-researched concept of virtual or remote teams, as often temporary formed expert teams with geographically dispersed members.

InterSoft (Pseudonym)

The studied team from InterSoft valued the ability to rely on the availability of team members during the workday. They worked *"roughly 9–17,"* as the manager said, and started the day with a synch meeting at 9:30 in the morning. In other words, the team established a *synchronous schedule mode*. At the same time, as a distributed-first company, InterSoft employees can freely choose whether they want to work predominantly in the office or predominantly from elsewhere (home or a coworking space). Employees are even allowed to move to another country with the manager's permission. The corporate program supporting remote work is called *work from anywhere*. In the studied team, members were distributed among Sweden (five members), The Netherlands (four members), the United Kingdom (two members), and Spain (one member). Even members from the same country did not align their office presence, making it an example of a *hybrid team*. The manager revealed that their work arrangement worked well for them, but likely due to the *synchronous mode*. When confronted with the ability to employ a new member from the United States, the manager had to reject the application since such a change would violate the ability to have aligned work schedules.

Valtech

The practitioner we met at Valtech worked with seven teams, most of which worked in a traditional *office mode*. The two remaining teams were distributed with subgroups working in different geographically distributed offices or WFX. All teams had *synchronous schedule mode*: *"[During] a normal working day before the pandemic, everyone would more or less be working at the same hours."* Back then, flexibility was limited to special occasions on an individual basis (e.g., doctor's appointments).

Throughout the forced WFH periods caused by the COVID-19 waves, the teams adjusted rapidly to *remote mode* with no clear policies regarding the work schedules. However, it was soon agreed that the time flexibility had to be *"in accordance to what the team needs"* and agreed on following a *core meetings mode* targeting morning synch meetings. As they highlighted: *"If the team has agreed on specific meeting times for shared meetings, you cannot plan your work so that you cannot attend those. But there might be people attending daily standups in the morning, and then basically wait with working until the afternoon."*

> Notably, flexible work policies do not always lead to erratic choices.

After COVID restrictions were lifted, most teams returned to the *office mode* as Valtech values colocation. However, the company also permits WFX in response to the employees' wishes. Therefore, Valtech promotes alignment on the *core meetings* so that employees and members of teams can more often WFX, while ensuring minimal disruption to teamwork dynamics.

IBM

Prepandemic, our contact at IBM worked with multiple teams of developers dispersed across offices in India and Denmark. Meeting occasions were fixed for these teams, with the remaining hours being fully flexible (*core meeting mode*): *"[.] if we had planned meetings then we would facilitate how that should actually go, and if we will work physical together, we would then kind of say–Guys, we meet, and we create those expectations [.] so that's how the meetings went, but the working hours [.], that has always been flexible."* However, despite working from their offices, most meetings were carried out online: *"[.] what we did a lot of the times was, even though we were colocated, we made sure to have noise canceling headsets, and we were sitting together on our own laptop, with our own screen, our own microphone headset, and being virtually together all of us. So, we would all have this barrier [level playing field]."* After the reopening of the offices, our informant switched to a single team dispersed among Denmark, Sweden, Finland, Austria, and Norway. All team members apart from the informant work remotely. In contrast, the informant works primarily from home, with two ad hoc days at the office per the current company policies. Given this flexibility and the time differences among the teams, their work arrangement provides an example of a *hybrid team* and schedule aligned for the *core meetings*.

Brandwatch

Before the pandemic, one of the teams at Brandwatch worked in a *partially aligned mode*, with majority of members working from their office in Copenhagen and one located in Bulgaria. This team also adjusted quickly to *remote mode* during the pandemic, and, given that

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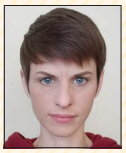

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the company has yet to establish any policies that would require employees to return to the office, the team has maintained their work arrangement in a *remote mode*: "*So nobody cares where people have been working from since forever. But, if before maybe there was a sentiment from employees that [the arrangement] was an exception, now maybe the sentiment is that it's not the rule, but it's just the normal thing.*"

Ericsson

The manager we met at Ericsson discussed his experiences from cooperating with other managers in the leadership team. Before the pandemic, all managers were fully present on site and worked in an *office mode*, which has, similarly to all other cases, changed with the pandemic waves that forced everyone to WFH in a *remote mode*. After the reopening of the offices, Ericsson decided to make its policies more flexible and allow employees to WFH 50% of the time within a calendar year. In other words, they are not restricting office presence to mandatory office days. As a result, while many managers in the leadership team have returned to regular office work, some alter office days with remote days of WFH, with one manager residing most of the time at home and commuting one day a week to the office. Overall, the team can be described as *partially aligned* with *semiremote mode* (one or several remote satellite workers). On the question of whether this setup is working well, the manager explains – "*It works, but after spending three days on site working closely together during the onsite workshops we had last week, it became clear that work in the same environment feels better.*" Further, he clarifies, "*I would prefer to have everyone on site to just be able to go and ask a question. Even though we [the leadership team] do not sit in one room, office presence makes such spontaneous discussions easier.*"

Work–life balance in the spotlight: We live in a period of transition, where well-being and work–life balance are perceived as more important than material incentives. Several studies and our own investigation have demonstrated that for some, well-being and work–life balance are associated with working predominantly in the office or a coworking space, for some with primarily WFH or the favorite café, and others with a mix of work

locations.[1,2,3,4,5,11,13] The importance of well-being and work–life balance will likely lead to an overall rethinking of the role of work in our societies, which is evident in the changes already implemented in corporate work policies.[5] Yet, a better understanding of the benefits, limitations, and required support for WFH in different groups is needed (e.g., women, caregivers, parents with small children), before choosing a one-fits-all plan.

New work arrangements have emerged from an increase in remote work: In this article, we contribute to the debate of what to expect in the future workplace and the destiny of teamwork considering flexible work arrangements. We define *hybrid teams* with members altering their office days and WFX days in an erratic manner, followed by a spectrum of partially aligned options, in which not all team members and/or not always have the level playing field work experiences. In the past, these work arrangements have been tightly associated with a negative impact on team performance, one of the main reasons why managers and coworkers have been opposed to the implementation of remote working.[13] Partially dispersed teams in the global and distributed software engineering research are infamous for division into subgroups and accompanying "us versus them" attitude, reduced team cohesion, increased coordination difficulties, alienation of remoters, and a significantly weaker sense of belonging.[18] The first studies of hybrid and remote-first teams emerging during the forced WFH also bring forward the first reports of coordination problems,[9] echoing the prepandemic findings.

Variegated arrangements work best for team-centered forms of collaboration: Like Santos and Ralph, we, too, worry about returning to the preagile processes.[9] However, given the positive experiences with fully remote WFH during the pandemic that ensured the level playing field experience for everyone, it is evident that teams that alter work in the office and WFX do not need to be hybrid or partially aligned. In our work, we have identified and focused the attention on *variegated teams*, which in contrast to hybrid and partially aligned teams, move between the office and the remote modes in an aligned fashion, thus keeping the level playing field experience and avoiding the challenges associated with the hybrid work mode. Our practical insights into the life of hybrid teams indicate that alignment is necessary and sought after, if not complete alignment (in the office, nine till five), then at least having an inevitable overlap in work schedules (core hours or core meetings). At the same time, our findings suggest that working from anywhere, anytime, and hiring people from anywhere might not be the best option unless companies allow team formation that maximizes the alignment among the team members by self-selecting like-minded peers.

> Today, companies often choose to delegate work arrangement decisions to immediate managers or teams or leave the choice to every employee, allowing a fully flexible policy.

The future of organizational culture is unclear: Lastly, we would like to express our concerns about the potential alienation from corporate cultures. Our informant from IBM describes this concern as one driver for mandatory office presence in companies: "*…People need to be in the office in the future, for at least two days a week. Because now it's becoming a habit just [working] from home and you're actually not part of the culture anymore.*" Companies that do not constrain where and when work can be performed may evidence days when everybody happens to be in the office and days when everybody works remotely, synchronously or asynchronously or anything in between. Similarly, different teams or departments within the same company may have diverse agreed-upon work arrangements. Companies with flexible policies may thus evidence the full spectrum of work arrangements within the same workplace. An important question to explore in the future will be the destiny and formation of corporate culture in a workplace with flexible work arrangements.

The different types of future organizations: We see several development scenarios for organizations. One scenario is the emergence of organizations with distinct work policies. It is fair to expect that based on the work policies and the dominance of individual preferences and team-agreed work

arrangements, we will likely see the rise of remote-first workplaces with smaller office spaces dedicated to collaborative activities. These will be organizations investing in workplaces for teams aligning on the core meetings mode, focusing on joint workshops in prebooked team spaces or joint virtual meetings instead of personal offices. With the growing realization that way too many offices are half-empty,[11] we believe that there will be organizations that will decide not only to reduce their office space but also go remote-only. Similarly, we believe that a few office-only and office-first workplaces will remain, even though evidence suggests that such companies will likely be very few.[5] Most companies, however, are likely to provide flexible/hybrid options.[5,9]

Remaining flexible is the key: Being flexible and not making irreversible changes in the workplace might be a winning strategy in the long term. After all, psychological and social effects of the pandemic are still guiding public opinion regarding work in the office, soon possible to swing in the other direction, as the tough economic times lean people toward office warmth and light. In any case, the spectrum of work arrangements will remain in the research focus in the years to come.

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Publication II

Khanna, D., Christensen, E. L., Gosu, S., Wang, X., and Paasivaara, M.
Hybrid Work meets Agile Software Development: A Systematic Mapping Study

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Hybrid Work meets Agile Software Development: A Systematic Mapping Study

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ABSTRACT

Hybrid work, a fusion of different work environments that allow employees to work in and outside their offices, represents a new frontier for agile researchers to explore. However, due to the nascent nature of the research phenomena, we are yet to achieve a good understanding of the research terrain formulated when hybrid work meets agile software development. This systematic mapping study, we aimed to provide a good understanding of this emerging research area. The systematic process we followed led to a collection of 12 primary studies, which is less than what we expected. All the papers are empirical studies, with most of them employing case studies as the research methodology. The people-centric nature of agile methods is yet to be adequately reflected in the studies in this area. Similarly, there is a lack of a richer understanding of hybrid work in terms of flexible work arrangements. Our mapping study identified various research opportunities that can be explored in future research.

KEYWORDS

Hybrid work, Agile software development, Flexible working, Remote working, Work-From-Home

ACM Reference Format:

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1 INTRODUCTION

Hybrid work is a setting where employees have the convenience to work both in the office space and in remote environments (i.e., home, outside office space) [2]. According to a recent article by Forbes[1] more than 95% of workers believe that hybrid work arrangements are better for their mental health. The same survey outlines that women prefer hybrid work to men. A psychologically and mentally safe working environment should be mandated in every organization [4]. If employees achieve better results with online or remote work, the practice should be encouraged [8]. Hybrid work is beneficial as it provides flexibility, saves the travel time to commute to the office, promotes the use of collaboration tools with effective communication practices, and enhances work-life balance [12].

Agile software development is used by many teams as it is a customer-focused approach [5], where software is delivered fast to market in short delivery sprints [9]. Agile software development also provides transparency to projects, enhancing collaboration and communication through cross-functional teams [3]. The work environment of teams in turn affects their development process, resulting in speeding up or slowing down the development [7]. To obtain an overview and understand the research prospects of hybrid work in agile software development organisations, we conducted a Systematic Mapping Study (SMS). An SMS helps to pinpoint areas and gaps that future research could address [15]. In addition, it helps to summarise and formulate the current research scope [14]. The systematic study of the convergence of hybrid work and agile software development provides insights into how organizations manage workflows, teams, online tools, processes, and established work policies.

As the nature of different types of work is evolving more after the Covid-19 pandemic [12] and several flexible workflows have been flourishing [20], a systematic study could offer research insights by showing several future trends, emerging technologies, and transformation, and providing an understanding of hybrid work and agile software development. We address the following research questions in this study.

[1] https://www.forbes.com/sites/chriswestfall/2023/07/05/over-95-of-workers-say-that-hybrid-work-is-best-for-mental-health/?sh=280bcba11b4d

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RQ1.) What are the publication trends and characteristics of existing research on hybrid work in agile software development?
RQ1.1.) What are the publication years and types of research articles on hybrid work in agile software development?
RQ1.2.) Which research methods have been employed in the published studies for hybrid work in agile software development?
RQ1.3.) In which countries and organizations has the research been carried out for hybrid work in agile software development?
RQ2.) Which research questions have been investigated in hybrid work in agile software development?
RQ3.) In which kind of hybrid settings is agile software development carried out?

To answer the above research questions we performed a systematic search on three well-known academic databases (ACM Digital Library, IEEE Xplore, and Scopus). We used "Hybrid" AND "Agile" AND "Software development" as three main keywords and inserted OR logic between their synonyms. Following the guidelines of [14, 15], we obtained 3191 studies, which were categorised into 'accept or yes', 'maybe', 'reject or no' and 'duplicate'. Seven relevant studies were selected after applying the inclusion and exclusion criteria. In addition, we used forward and backwards snowballing on the seven papers, which resulted in an additional 485 papers. Again, after applying our inclusion and exclusion criteria, we found five more relevant articles from forward snowballing and none from the backward search. In total, we discovered 12 relevant studies. All the papers are empirical studies, with most of them employing case studies as the research methodology. Our mapping study identified various research opportunities that can be explored in future research.

In Section 2 we provide a brief overview of the background, including the conceptual framework and model we have applied in this study. Section 3 describes the research steps followed. We present the results in Section 4. Finally, we discuss our findings in Section 5, and provide concluding remarks in Section 6.

2 BACKGROUND

After Covid-19, the working model for many has changed to work-from-home (WFH), work-from-anywhere (WFX) [6], remote work [21], or hybrid work [2]. The term hybrid has recently gained popularity as a catch-all for a number of phrases used in the workplace, and the term is often used and interpreted in different ways. In this study, we use the definition proposed by Conboy et al. [2]:

"Hybrid software development is where some team members work mostly or completely from home, others mostly or completely from the traditional office, and others in some combination of the two—not quite distributed and not quite co-located but, rather, individuals working from anywhere and touching base with the office intermittently".

This definition excludes work settings where all individuals work either exclusively from the office, or only remotely.

As far as we are aware of, there is no existing work that offers a good overview of the research area at the intersection of hybrid work and agile software development. This is the primary motivation for us to conduct this mapping study.

To analyse the research questions investigated in the papers selected for this study, and to answer RQ2, we chose the framework suggested by Paasivaara and Wang [13] and illustrated in Figure 1. This framework has been used to organise research topics on hybrid work in Software Engineering (SE) [13]. To further categorize the hybrid settings investigated in these studies, and to answer RQ3, we employed a model suggested by Smite et al. [19], that is shown in Figure 2. This model suggests various types of hybrid settings in terms of team typology and work arrangements.

2.1 Framework for organising research questions

According to Paasivaara and Wang [13], research on hybrid work in SE can be organised into three different categories:

- Those that investigate the *factors* that influence various policies and implementations of hybrid work:
- Those that examine hybrid work arrangements and policies (*hybrid work in SE*):
- Those that analyse the *impacts* of hybrid work.

These three categories of research topics can be studied from different perspectives. The three typical perspectives are *People*, *Process*, and *Product*, the so-called "3 P's" in software management [17]. The *people* perspective can be further divided into *individual, team,* and *organisational* levels.

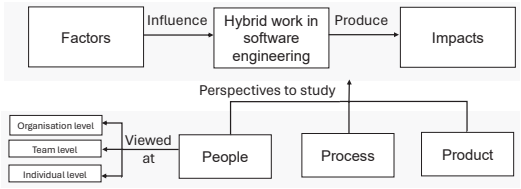

Figure 1: A conceptual framework for organizing research questions on hybrid work in SE [13]

To make the framework more concrete, a study that investigates *factors* influencing the adoption of hybrid work can do so from the *people* perspective at the *individual level*, studying what personal factors might influence the choice of work mode, e.g., personality or cultural background differentiated by a power distance. A study that examines hybrid work arrangements in software companies from the *process* perspective could be, for example, understanding how agile methods can be adjusted for hybrid work. Studies on which tools can be used and how they can best support hybrid work in SE also fit to the same category.

To study the impacts of hybrid work on an organisation from the *product* perspective, an example is given in [13]: would Conway's Law [11] still be applicable in hybrid work? If yes, it would be relevant to investigate how it would be manifested in such settings.

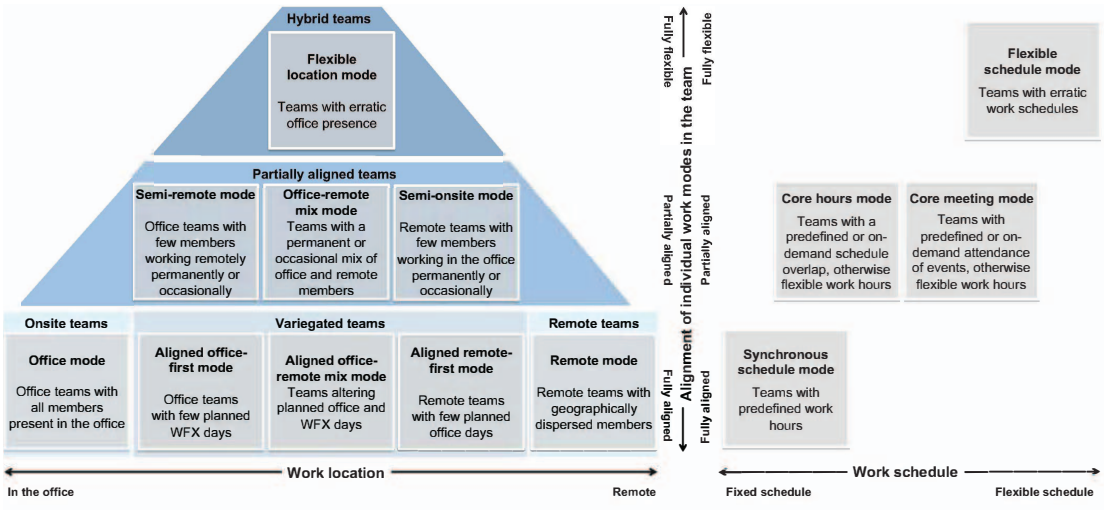

Figure 2: Team typology and the spectrum of work arrangements [19]

2.2 Model for analysis of hybrid work settings

To achieve clarity in the understanding of arrangements of software teams working in hybrid settings, Smite et al. [19] propose utilizing a team typology and multidimensional model of work arrangements. The two core dimensions of the model are *work location* and *work schedule* (Figure 2 – horizontal axis), and the various arrangements within these two dimensions are categorized according to their degree of alignment (Figure 2 – vertical axis). The typology provides a vocabulary for the work arrangements of teams specifically. It is, therefore, only applied in this study to categorize the hybrid settings in studies where team work arrangements have been explored.

Similar to the definition of hybrid provided in [2], within the work location dimension, the model distinguishes between arrangements where all individuals are working either fully onsite or fully remote. The proposed definition of **hybrid** teams is, however, limited to work arrangements where individuals in the team have an erratic office presence with no alignment (*flexible location mode*).

The remaining types of teams are defined as either: 1) **partially aligned**, which surfaces when members do not always align, or when everybody's arrangements are not aligned, or 2) **variegated**, which are distinguished by predefined but altering work locations. Within each of these two degrees of alignment, three different archetypes of work modes are defined: 1) *semi-remote mode*, *office-remote mix mode*, and *semi-onsite mode*, and 2) *aligned office-first mode*, *aligned office-remote mix mode*, and *aligned remote-first mode*.

Regarding the work schedule dimension, the model distinguishes between four different modes: 1) *synchronous mode* with fully aligned work hours, 2) *flexible mode* with erratic work schedules, 3) *core hours mode* with specific time overlaps, but otherwise flexible schedules, and 4) *core meeting mode* with alignment around scheduled meetings or events, but otherwise flexible schedules.

3 RESEARCH STEPS

Figure 3 shows the steps we followed in conducting the systematic mapping study, according to the guidelines by Petersen et al. [14, 15].

3.1 Search strategy

3.1.1 Keyword search. We used the AND logic between the central concepts, i.e., "Hybrid" AND "Agile" AND "Software development". We used OR logic between the synonyms of sets 1, 2 and 3. Later, we combined the three sets to reach the final search string, i.e., **(SET 1 AND SET 2 AND SET 3)**. Following are the three sets:

- SET 1: Scoping the search for hybrid work. Therefore, we consider ***(hybrid work OR blended work OR Covid-19 OR distributed teams OR mixed work OR online collaboration OR pandemic OR remote and on-site work OR remote collaboration OR virtual collaboration OR virtual teams OR work from anywhere OR work-from-home OR e-work OR flexible OR telecommunication OR telework OR teleworking)***.
- SET 2: Search terms are directly related to agile. Hence, we consider ***(XP OR agile programming OR extreme programming OR Kanban OR lean OR scaled agile OR scrum)***.
- SET 3: Search term is related to software development. Hence, we consider ***(SE teams OR programming team OR programming teams OR software developer OR software developers OR software development OR software engineer OR software engineering OR software evolution OR software life cycle OR software maintenance OR software process OR software professional OR software professionals OR software project OR software projects OR***

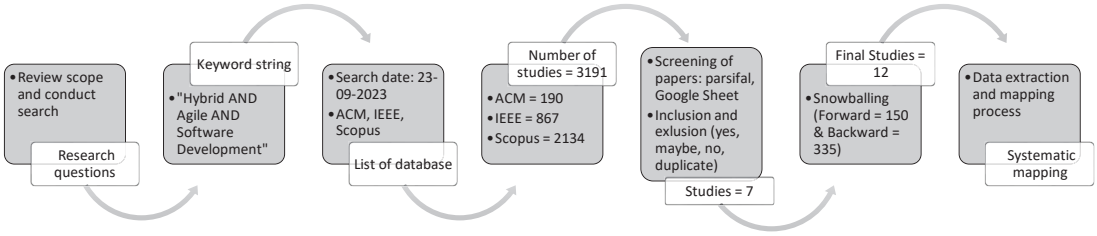

Figure 3: Research Steps based on guidelines mentioned in the study [14, 15]

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software quality OR software system OR software systems OR software team OR software teams).

3.2 Screening and selection

We used three well-known academic databases to retrieve the studies [10]. The three libraries we used are ACM Digital Library, IEEE Xplore, and Scopus. We conducted our search on 23-09-2023, as keywords, abstract and title search. As shown in Figure 3, we obtained 3191 studies (ACM: 190, IEEE: 867, and Scopus: 2134). We imported all studies into Parsifal, an online tool that helps researchers conduct systematic reviews within software engineering. Next, we used the following inclusion and exclusion criteria to select the studies. An included study had to fulfill all the inclusion criteria, whereas for exclusion, fitting to one or more criteria would exclude the paper.

3.2.1 Inclusion Criteria.

(1) Studies conducted in professional settings in hybrid and agile environments.
(2) Studies published in the time frame since the establishment of the Agile Manifesto [1], hence, from 2001 to Sept 23rd, 2023.
(3) Studies that provide an answer to at least one of our research questions.
(4) Studies considering employees working in hybrid work settings.

3.2.2 Exclusion Criteria.

(1) Studies outside the scope of hybrid work and agile software development.
(2) Editorials, invited papers, research proposals, self-archived, non peer-reviewed studies, non peer-reviewed books or book chapters, summaries of conference proceedings with titles, theses and dissertations, reports, technical reports, working papers, white papers, patents, or grey literature (magazines, articles).
(3) Studies that are duplicates of other studies.
(4) Studies outside the professional work settings, e.g., student or education projects and secondary studies.
(5) Studies that are not written in English.

3.2.3 Title, abstract, full text screening, and data extraction. Two authors reviewed the titles and abstracts of all 3191 papers. From Parsifal, then we exported the results to Google Sheets. We categorised each paper into *'accept or yes'*, *'maybe'*, *'reject or no' and 'duplicate'*. In the screening process we found 756 *'duplicate'* and 2409 *'reject or no'* studies. The 21 studies categorised *'maybe'* were discussed by four authors and based on the discussion we classified either to *'accept'* or *'reject'* the paper. We found seven papers from the main search that passed the inclusion and exclusion criteria.

Subsequently, we performed forward and backward snowballing on these seven papers, as well as a few key papers (e.g., [2]). We found 150 candidate publications from forward and 335 from backward snowballing for further screening. After using the inclusion and exclusion criteria, we found five relevant papers. The papers we obtained from the forward snowballing search are: S4, S6, S7, S8, S12 (see table 1). We obtained no studies from the backward snowballing search. In total, we performed full-text screening for: 7 (main search) + 5 (forward snowballing) = 12 primary studies for conducting systematic mapping. We developed a data extraction sheet, in order to collect information from these studies. The data extraction form can be retrieved online[2].

In the next section, we will provide answers to the research questions asked in this mapping study.

4 RESULTS

4.1 RQ1.) What are the publication trends and characteristics of existing research on hybrid work in agile software development?

Table 1 shows the list of the reviewed studies sorted by year with authors' names and titles of the papers. In the table's first column, we mentioned the serial number, i.e., S1–S12. The second column first describes the author's names and then the study's title. Finally, the last column outlines the year the study was published. We can notice in Table 1 that several authors had two or more publications, for example, (S5 & S6), (S5 & S7), (S4 & S7), and (S10 & S11).

RQ1.1.) What are the publication years and types of research articles on hybrid work in agile software development? As evident from Figure 4, we can see a rising trend in the number of papers after Covid-19. The horizontal axis in Figure 4 represents the study number, and the vertical axis represents years. Only two papers (S1, S2) were published prior to the pandemic, i.e., in 2016 and 2018 respectively. The remaining studies (S3–S12) were published in 2022 and

[2]https://doi.org/10.6084/m9.figshare.24547204.v1

Table 1: The list of the reviewed studies

No.	Authors and *title of the study*	Year
S1	**Advait Deshpande, Helen Sharp, Leonor Barroca, and Peggy Gregory** *"Remote Working and Collaboration in Agile Teams"*	2016
S2	**Pernille Lous, Paolo Tell, Christian Bo Michelsen, Yvonne Dittrich, and Allan Ebdrup** *"From Scrum to Agile: a Journey to Tackle the Challenges of Distributed Development in an Agile Team"*	2018
S3	**Michael Neumann, Habibpour Daryosch, Eichhorn Dennis, John A, Steinmann Stefan, Farajian L, and David, Mötefindt** *"What Remains from Covid-19? Agile Software Development in Hybrid Work Organization: A Single Case Study"*	2022
S4	**Darja Smite, Nils Brede Moe, Anastasiia Tkalich, Geir Kjetil Hanssen, Kristina Nydal, Jenny Nøkleberg Sandbæk, Hedda Wasskog Aamo, Ada Olsdatter Hagaseth, Scott Aleksander Bekke, and Malin Holte** *"Half-Empty Offices in Flexible Work Arrangements: Why are Employees Not Returning?"*	2022
S5	**Tor Sporsem and Nils Brede Moe** *"Coordination Strategies When Working from Anywhere: A Case Study of Two Agile Teams"*	2022
S6	**Tor Sporsem, Audun Fauchald Strand, and Geir Kjetil Hanssen** *"Unscheduled Meetings in Hybrid Work"*	2022
S7	**Anastasiia Tkalich, Darja Smite, Nina Haugland Andersen, and Nils Brede Moe** *"What Happens to Psychological Safety When Going Remote?"*	2022
S8	**Zhendong Wang, Yi-Hung Chou, Kayla Fathi, Tobias Schimmer, Peter Colligan, David Redmiles, and Rafael Prikladnicki** *"Co-designing for a Hybrid Workplace Experience in Software Development"*	2022
S9	**Jedrzej Bablo, Bartosz Marcinkowski, and Adam Przybylek** *"Overcoming Challenges of Virtual Scrum Teams: Lessons Learned Through an Action Research Study"*	2023
S10	**Safinaz Buyukguzel and Ufuk Balaman** *"The spatial organization of hybrid Scrum meetings: A multimodal conversation analysis study"*	2023
S11	**Safinaz Buyukguzel and Robb Mitchell** *"Progressivity in Hybrid Meetings: Daily Scrum as an Enabling Constraint for a Multi-Locational Software Development Team"*	2023
S12	**Kai-Kristian Kemell and Matti Saarikallio** *"Hybrid Work Practices and Strategies in Software Engineering-Emerging Software Developer Experiences"*	2023

2023. As visible in Figure 5, seven primary studies were published in conferences, while five were published in journals. Studies S6, S7 and S8 were published in IEEE Software, and studies S10 and S12 were published in Discourse & Communication, and IEEE Access respectively.

The conferences were: International Conference on Information Systems (S1), International Conference on Software and System Process (S2), International Conference on Software Engineering Research and Innovation (S3), International Conference on Product-Focused Software Process Improvement (S4), International Conference on Agile Software Development (S5, S9), and ACM Conference On Computer-Supported Cooperative Work And Social Computing (S11). Thus, only one conference had published two papers that were included.

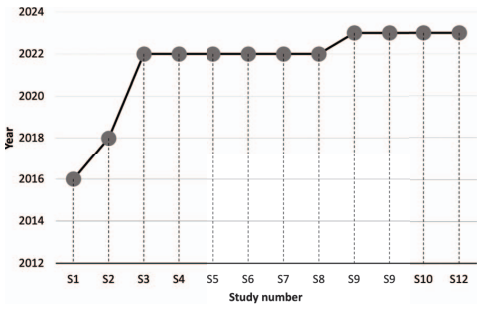

Figure 4: Yearly distribution of the studies

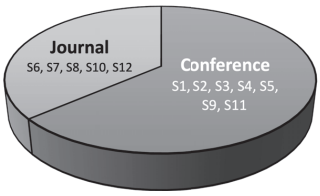

Figure 5: Publication types: journals vs. conferences

RQ1.2.) Which research methods have been employed in the published studies for hybrid work in agile software development? All twelve primary studies applied empirical research methods (see Figure 6). We did not find any conceptual studies, position papers, systematic literature reviews, systematic mapping studies, or multivocal literature reviews. From the obtained studies, we found that the majority used case study as the empirical method to conduct the investigation. This method was applied in nine studies (S2–S7, S10–S12). The remaining three studies used experiment (S1), design science research (S8), and action research (S9).

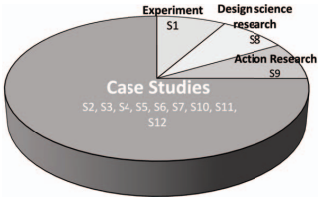

Figure 6: Types of empirical studies

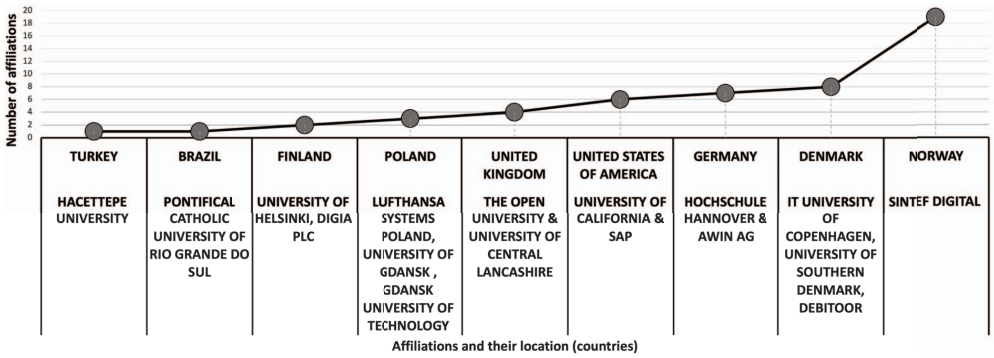

Figure 7: Authors affiliations and their locations

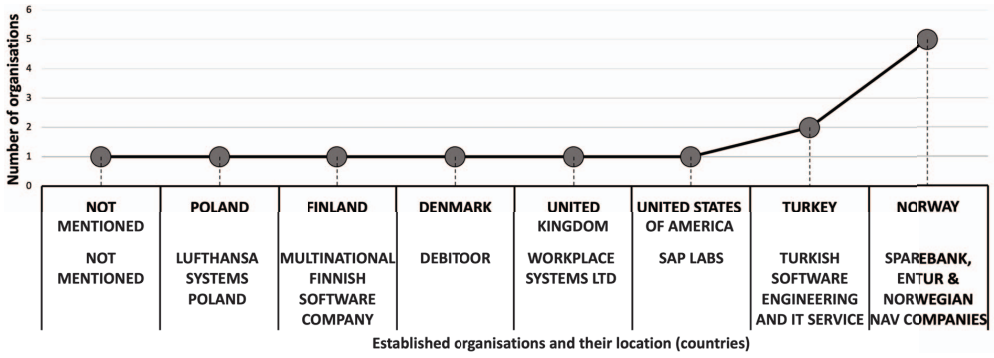

Figure 8: The studied organisations and their locations

The data collection techniques used in the primary studies included interviews (S1, S2, S4, S5, S7–S9, S12), observations (S1, S2, S5, S6, S9–S11), surveys (S3, S4, S7, S9), group discussion (S1), notes from virtual stand-ups (S5), collection of other available data, i.e., office attendance, meetings data, and strategy documents (S7), co-design workshops (S8), and focus groups (S9).

It is noticeable that most of these studies (ten, S1–S3, S5–S11) have 'team' as the level of analysis, whereas S4 and S12 used 'individual'.

RQ1.3.) In which countries and organisations has the research been carried out for hybrid work in agile software development? We found that the research has primarily been carried out in European countries, with Norway dominating the research trend, as visible in both Figures 7 and 8. Only one study, S8, was carried out in the USA (California).

The horizontal axis of Figure 7 represents the country and affiliation of the authors, while the vertical axis shows the count of the affiliation. For example, Figure 7 shows that 19 authors are from Norway, all affiliated with 'SINTEF Digital'. Whereas, a total of eight authors are located in Denmark, under three different affiliations: IT University of Copenhagen (4 authors), University of Southern Denmark (3 authors), and Debitoor (1 author). The other countries represented in the studies are Poland, Finland, United Kingdom, Turkey, USA, and Brazil. Focusing on the affiliation, the highest number of researchers (19) are from 'SINTEF Digital, Norway', followed by eight research affiliations from Denmark including 'IT University of Copenhagen, University of Southern Denmark, and Debitoor, Denmark', and seven research affiliations from Germany, including 'Hochschule Hannover', and 'AWIN AG'.

Concerning the studied organisations, the horizontal axis in Figure 8 represents the organisations that are studied in the articles, and the country they are located in. The vertical axis shows the count of the organisations which are represented. For example, in Figure 8, the count is five for Norway. This is because Sparebank was involved in two studies (S4, S7), and Entur in two (S5, S6), and Norwegian Labour and Welfare Administration (NAV) was involved once (S6). Whereas for Turkey, a Turkish software engineering & IT service providing company was involved in both S10 and S11, summing up the count to two. As shown in Figure 8 one study (S3) did not mention the organisation and country information. But

Table 2: Research questions mapped to *the conceptual framework for organizing research questions on hybrid work in SE* [13]

No.	Research questions	Factors	Hybrid Work in SE	Impact
S1	RQ1: What kind of issues (if any) are faced by a hybrid agile team in practice?			Process
	RQ2: How does a hybrid agile team with a remote worker collaborate?		Process, People (Individual)	
	RQ3: How does the experience of remote working compare between a remote worker and his colocated teammates in a hybrid agile team?			Process
S2	RQ: How can a development team adopt an agile process without compromising on the core values and principles when facing the challenges of distributed development?		Process	
S3	RQ1: Which work organization type (remote or onsite) is preferred by the members of agile software development teams operating currently in a remote work setting?	Process, People (Individual)	Process, People (Individual)	
	RQ2: Which organization type (remote or onsite) support the use of specific agile practices from a team member point of view of agile software development teams?		Process, People (Individual)	
	RQ3: How can we perform agile practices in a hybrid work setting?		Process	
S4	RQ1: How often are employees present in the office?	People (Individual)		
	RQ2: What hinders and what motivates employees to visit the office?	People (Individual)		
S5	RQ: What coordination strategies are used by agile teams when working from anywhere?	Process		
S6	RQ: How do developers maintain unscheduled meetings in post-lockdown work life?		Process, People (Individual)	
S7	Research objective: The study investigates how different work modes affect software teams' psychological safety.			People (Team)
S8	RQ: How to design for and continuously improve a workplace experience with software development teams while transitioning to a hybrid work arrangement?		Process, People (Team and Organisation)	
S9	RQ1: How did Scrum teams adapt their practices and processes due to the ad-hoc shift to remote work?		Process	
	RQ2: What are the advantages of remote work for Scrum team members?			Process
	RQ3: What new challenges are faced by virtual Scrum teams and their members?			Process
	RQ4: How can these challenges be mitigated?			Process
S10	Research objective: The study examined hybrid Scrum meetings in order to understand how space is co-constructed in them.		Process	
S11	RQ: How do participants ensure progressivity and get the work done in hybrid meetings despite disruptions?		Process	
S12	RQ1: What factors influence the work mode preferences of software developers, and why?	People (Individual)		
	RQ2: How could alternating between remote work and working on-site alleviate the challenges associated with each work mode while leveraging the benefits of both?			People (Individual)

referring to the previous Figure 7, the author's affiliation belongs to 'Hochschule Hannover, and AWIN AG, Germany'.

4.2 RQ2.) Which research questions have been investigated in hybrid work in agile software development?

As shown in Table 2, a total of 19 research questions were investigated in the reviewed studies: 11 (How), 6 (What), and 2 (Which). In studies S7 and S10 only the research objective was stated, which is included in Table 2. We mapped the research questions and objectives according to *the conceptual framework for organizing research questions on hybrid work in SE* [13], to show both the categories and perspectives represented. We found that the largest number of research questions (10) could be mapped to the *hybrid work in SE* category (S1–S3, S6, S8–S11). Following this, seven research questions were mapped to the *impact* of hybrid work (S1, S7, S9, S12), and five research questions to influencing *factors* (S3–S5, S12).

As can be seen in Table 2, only one of the research questions was mapped to more than one category (S3: RQ1). However, multiple research questions could be mapped to more than one of the "3 P's" perspectives of the framework [13]. Mostly, the studied research questions fall under the *process* perspective, followed by the *people (individual)* perspective. Just two map to the *people (team)* perspective, while one mapped to the *people (organisation)* perspective. Our mapping did not reveal any research questions in these studies that could be mapped to the *product* perspective.

4.3 RQ3.) In which kind of hybrid settings is agile software development carried out?

The following work arrangements, online tools for hybrid work, hybrid work policies, agile frameworks, practices, and roles have been identified in the reviewed studies.

Work arrangements: Based on the team typology and model presented in Figure 2 from [19], we identified the following work arrangements, which are shown in Table 3. As previously mentioned, in contrast to all the other primary studies, the level of analysis in S4 and S12 was carried out on a individual basis, so team work arrangements were not investigated.

Regarding the work location arrangements, **partially aligned** teams were identified in five of the studies, with two of these studies specifying *semi-remote mode* (S1, S2), while the remaining three specified *office-remote mix mode* (S5–S7). **Variegated** teams were identified in three of the studies as well, with two of the studies specifying work in *aligned office-remote mix mode* (S6, S8) and the other in *aligned remote-first mode* (S9). In addition, **hybrid** teams working in *flexible location mode* were identified in S7. The remaining studies (S3, S4, S10–S12) do not map to exact arrangements as described in [19].

Regarding the work schedule arrangements, teams in studies S6, S7, and S9 worked in *synchronous schedule mode* on the planned office days, but the schedule of the remaining work days was not specified. Teams in study S8 also worked in *synchronous schedule mode* on the planned office days, but worked in *core meeting mode* and *core hours mode* during planned WFX days. *Core meeting mode* was also identified in studies S1, and S7. The work schedule was not described for one of the teams in studies S6 and S7, or in the remaining seven studies (S2–S5, S10–S12).

Table 3: Work arrangements mapped to team typology and model [19]

No.	Work location modes	Work schedule modes
S1	*Semi-remote* (partially aligned team)	*Core meeting*
S2	*Semi-remote* (partially aligned team)	Not specified
S3	Alignment not specified	Not specified
S4	Not specified	Not specified
S5	*Office-remote mix* (partially aligned team)	Not specified
S6	Team 1: *Aligned office-remote mix* (variegated team) | Team 2: *Office-remote mix* (partially aligned team)	Team 1: *Synchronous schedule* on planned office days (other days not specified) | Team 2: Not specified
S7	Team 1 & 3: *Flexible location* (hybrid team) | Team 2: *Office-remote mix* (partially aligned team)	Team 1: *Core meeting* | Team 2: *Synchronous schedule* on planned office days (other days not specified) | Team 3: Not specified
S8	*Aligned office-remote mix* (variegated team)	*Synchronous schedule* on planned office days, *core hours & meeting* other days
S9	*Aligned remote-first* (variegated team)	*Synchronous schedule* on planned office days (other days not specified)
S10	Alignment not specified	Not specified
S11	Alignment not specified	Not specified
S12	Not specified	Not specified

Online tools: In total, 35 online tools used in hybrid work to support agile software development were identified in the reviewed studies. Only one of the studies (S4) did not mention any online tools. The number of mentions for each tool can be viewed in Table 4. Atlassian Jira and Slack were both mentioned in six studies. Microsoft Teams was mentioned in five studies, while Atlassian Confluence, digital whiteboards, and Mural were mentioned in three studies. Discord, Microsoft Outlook, and Miro were mentioned in two studies, and the remaining 26 tools were mentioned only once.

Table 4: Online tools to support hybrid work in agile software development

Online tools	Mentions
Atlassian Jira, Slack	6
Microsoft Teams	5
Atlassian Confluence, Digital Whiteboards, Mural	3
Discord, Microsoft Outlook, Miro	2
Digital Boards (Kanban, Scrum), Appear.in, Asana, Atlassian Bitbucket, GitHub, Google Hangouts, Google Sheets, Google Slides, Hatjitsu, Hipchat, Lucidchart, Mentimeter, Microsoft SharePoint, MySQL, PhpStorm, PlanITPoker, Scrum Poker, Skype for Business, Sourcetree, TeamRetro, Timbo, Trello, Waffle.io, Webex, Zoom	1

Hybrid work policies: In Table 5 we present the hybrid work policies identified in the studies, mapped to the *people* perspectives of the framework (Figure 1) [13], and the underlying *individual*, *team*, and *organisational* levels. Mostly, the studies show that the company policies around hybrid work can be mapped to the team (S1, S5, S6, S8) or individual (S2–S4) levels, as the employees or teams are allowed to work **wherever**. In addition, S3 also states that work can be carried out **whenever**. The hybrid work policy in S7 can be mapped to both the individual and team levels, allowing work to be carried out **wherever**.

Only three studies revealed policies that could be mapped to the organisational level, with S9 requiring employees to be present at the office one day per week, and S12 required only an occasional day at the office. The policy in S8 specified three mandatory office days per week, and a flexible schedule for the two WFX days (outside of core hours and meetings). The remaining two reviewed studies, S10 and S11, did not reveal clear policies for hybrid work.

Table 5: Hybrid work policy mapped to the *conceptual framework for organizing research questions on hybrid work in SE* [13]

No.	People perspective	Hybrid work policy
S1	Team	Wherever
S2	Individual	Wherever
S3	Individual	Wherever & whenever
S4	Individual	Wherever
S5	Team	Wherever
S6	Team	Wherever
S7	Individual & team	Wherever
S8	Team & organisation	Three mandatory office days, flexible schedule during WFX (outside of core hours and meetings)
S9	Organisation	One mandatory office day
S10	Not specified	Not specified
S11	Not specified	Not specified
S12	Organisation	Occasional office day

Agile frameworks, practices, and roles: Table 6 outlines the entire list of agile frameworks, practices, and roles, which were mentioned in the studies. We found that seven of the primary studies (S1–S3, S8–S11) described Scrum specifically as the agile framework used, while three of the studies discussed Kanban (S2, S4, S12). The remaining studies mentioned varying agile frameworks, practices, and roles, including Scrum Master (SM), Product Owner (PO), product manager (PM), Sprint Retrospective, Sprint Planning, backlog meetings, product backlog refinement meetings, and daily standups. Study S8 provided the most detailed account of agile practices, as can be seen in Table 6. Studies S6 and S7 did not mention any specific agile frameworks, practices or roles, but the companies involved were the same as in S5 and S4, respectively.

Table 6: Agile frameworks, practices, and roles

No.	Agile frameworks	Practices	Roles
S1	Scrum	Agile release cycle, daily stand-ups	SM, PO, tester
S2	Scrum, Kanban		
S3	Scrum	Sprint, Scrum poker	Quality specialist, SM
S4	Scrum, Kanban	Backlog meetings, daily stand-ups	
S5	Various agile methods	Virtual stand-ups	
S6	Not specified		
S7	Not specified		
S8	Large-Scale Scrum (LeSS)	Sprint Planning, Sprint Review, team retrospective, overall monthy retrospective, multi-team review, daily stand-up, SM sync, overall PBR, single-team PBR, multi-team PBR, collaborative sessions (software and UX design, peer code reviews, pairing)	Software engineers, UX designers, PM
S9	Not specified	Scrum Events, Sprint Planning, team retrospective, poker	
S10	Scrum		
S11	Scrum	Daily Scrum	
S12	Kanban		SM

5 DISCUSSION

The findings from our mapping study show that the research at the intersection between hybrid work and agile software development is on the rise, especially after the Covid-19 pandemic, with six of the reviewed studies published in 2022, and four in 2023 (by September 23rd). It is expected that the trend will keep increasing as more software companies speculate and experiment on hybrid work, the "new normal" way of working [13].

With the rise of published articles [22], the understanding of hybrid work concerning work settings may be enhanced and strengthened. The small number of selected studies, only twelve papers, was lower than what we expected. The reason for that might be that hybrid work was not a big thing before the Covid-19 pandemic and only the pandemic gave rise to its' popularity. Studies performed during the Covid-19 pandemic were done mainly in fully remote settings (e.g., [16, 18]), instead of hybrid, due to the lockdown of society. Thus, it seems that after the pandemic only a few studies have been published so far, most probably due to research lagging a bit behind, since it takes time for researchers to conceive, design, implement and eventually publish a piece of research. However, companies are performing their own internal studies, as they are desperately trying to find solutions to the current hybrid work situation (e.g. Spotify[3]). Thus, our main finding is that this research topic, hybrid work in agile software development, is surprisingly under-researched and would need more empirical studies so that research could support software engineering companies that are currently pondering what to do and how to best organize hybrid work.

Our second, interesting finding was the fact that the studies found were mainly performed in Europe and studied European organizations, while only one paper (S8) came from outside Europe, from the US. Moreover, seven papers came from the Nordic countries, with five from Norway, one from Denmark, and one from Finland. Thus, it seems that this topic is interesting especially for European companies and researchers and even more so in the Nordic countries. The reason for this might be that there are stronger mandates for knowledge workers in other parts of the world to return to their offices than their European counterparts, so hybrid work is not such a big thing there. In addition, especially Nordic software engineers seem to have a stronger preference for hybrid work. However, hybrid work is a global phenomenon, and to better understand whether it is the "new normal" way of working and is here to stay for a long time, we encourage more research on hybrid work in agile organisations in other geographical locations.

Covid-19 forced software engineers to move to using fully digital tools and replace whiteboards, post-it notes and markers with online tools. Many of the same tools are still in use while in the hybrid setting. In total, our study revealed 35 different online tools used to support hybrid work in agile software development. In the future, it would be interesting to study whether these online tools provide adequate support for hybrid work, or if new and different types of supporting tools are needed, such as physical tools to boost innovation. It would be interesting to study as well how agile software teams are using these tools and how they could best support hybrid work.

The analysis of the research questions asked in the reviewed studies (answer to RQ2, Table 2) shows a strong concentration of the *process* perspective on hybrid work taken in these studies, and much less studies taking the *people* perspective. Given the fact that the reviewed studies are conducted in organisations that apply agile methods, and agile methods embrace "focus on people" as a key agile value, we found this finding intriguing. It indicates a potential research gap that deserves the attention of more researchers active in the intersection of hybrid work and agile software development research areas. For example, future research could be carried out taking the *people* perspective at the organisational level, to investigate how organisational factors could influence hybrid work settings, or how agile organisations could better arrange hybrid work, and/or what are the consequences of such work arrangements on the innovation capability of the organisation.

As evident in Section 4.3, the mapping of hybrid work arrangements to the model presented in [19] shows that over half of the primary studies (S2, S5–S7, S10, S11) do not investigate the work schedule of all the software teams involved. Similarly, the schedule of one team from both studies S6 and S7, and the teams in S9, is only apparent during the planned office days, where the teams work together onsite. In addition, results from the work location mapping show that the alignment of teams is not always investigated. We recommend that future studies could include the varying work schedule modes of hybrid work, as well as the degree of team alignment regarding the work location, as mentioned in the model [19].

Since we are mapping the research terrain at the intersection of hybrid work and agile software development, an interesting topic to ponder on when conducting a study in this area is, which one is the focus of the study, 'hybrid work' or 'agile software development'? The emphasis of 'hybrid work' or 'agile software development' changes the perspective of the study. Most reviewed studies focused

[3]https://newsroom.spotify.com/2021-02-12/distributed-first-is-the-future-of-work-at-spotify/

on hybrid work, taking agile software development as research settings. Relatively less studies have investigated the adoption and adaptation of agile methods in hybrid work settings. More studies along this line would be a welcome addition to the body of knowledge of agile research. Emphasizing 'agile software development' before 'hybrid work' could reveal specific hybrid work settings that are just supporting or beneficial for executing agile software development.

Threats to validity. This study might have a selection bias where the specific criteria we considered to include and exclude the study might bring biases to the results. To overcome this, we carefully followed the guidelines mentioned in [14] and [15]. Four of the five authors were on board to finalise the inclusion and exclusion criteria. Another threat could be the search strategy bias with the keywords. To overcome this, we considered several synonyms of the main three keywords and formulated them into sets as shown in Section 3.1.1. We conducted pilot studies with various combinations of the sets, and lastly, we finalised the mentioned keywords. Finally, as the search was conducted on title, keywords and abstract fields of the articles, and not to the full text, some papers not mentioning our search terms in those parts, could have been omitted. To mitigate this, we did forward and backward snowballing with the selected papers and a few key papers.

The study could face threats related to data extraction, which could lead to several errors and inconsistencies. To minimise this threat, four authors were involved during the data extraction procedure. In addition, two authors reviewed all the initial 3191 studies and 485 snowballing studies.

Limitation of the study. The number of the reviewed studies presents the major limitation, as we obtained results from only 12 studies. This limited literature collection constrained the breadth of our systematic mapping study. Another limitation is the variation of keywords, i.e., the use of 'hybrid' or 'agile', which was previously discussed. In line with this limitation is the use of keywords, as synonyms of software development could change the number of results in the study.

6 CONCLUSIONS

This systematic mapping study provides a broad overview of the emergent research area at the intersection of hybrid work and agile software development. We screened 3191 papers obtained through the keyword search and 485 through snowballing. After applying inclusion and exclusion criteria, we selected 12 primary studies. These papers studied 21 research questions, and described multiple hybrid work settings in agile organizations including work arrangements, online tools, hybrid work policies, as well as agile practices used.

Even though our mapping study shows a rising trend of research in the intersectional area of hybrid work and agile software development, especially after the Covid-19 pandemic, the number of studies is still low, despite the fact that hybrid work is of high interest for various companies practicing agile software development. Thus, there is a clear need for empirical research on hybrid work in agile software development organizations to be able to support them to thrive in the new working environments.

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Publication III

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On the evolution of agile software team work arrangements☆

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ABSTRACT

The IT industry has undergone a significant transformation over the past years, and many companies and software teams have been experimenting with different policies and work arrangements. In this multiple-case study, we explore the evolution of organizational policies and the work arrangements of 28 agile teams, and report on their effects, based on interviews with seven individuals in leadership and support roles, from six companies. Our findings reveal the emergence of a dynamic and evolving spectrum of work arrangements and organizational policies, reflecting an increased flexibility in accommodating diverse work schedules and locations. We identified complex and interrelated impacts at the organizational, leadership, and team levels. At the organizational level, underutilized office spaces pose new challenges for resource management and strategic planning. At the leadership level, managers and team leaders reported diminished visibility and awareness of team activities under certain arrangements. At the team level, policies reshaped the physical and virtual workspace, influencing creativity, communication patterns, and coordination demands, with some arrangements requiring enhanced mechanisms for coordination. Our findings further substantiate concerns raised by both scholars and managers about the impacts of evolving organizational policies and work arrangements.

1. Introduction

The IT industry has undergone a significant transformation over the past years, as a result of the restrictions imposed by the Covid-19 pandemic, and many companies and software teams have been experimenting with different policies and work arrangements, as discussed by, for example, Šmite et al. (2023a), Conboy et al. (2023) and Moe et al. (2023). Early experiments were already tested prior to the pandemic (Bloom et al., 2015; Deshpande et al., 2016; Lous et al., 2018). However, now that societies have reopened after the pandemic, a unique opportunity has emerged that allows the IT sector to revisit, redesign, and challenge assumptions about the characteristics of the optimal work environment for and arrangements of software teams.

As identified in Boland et al. (2020), *"leading organizations will boldly question long held assumptions about how work should be done and the role of the office"*. This assessment is in line with recent industry trends: (i) employees' needs are shifting as they demand more flexibility in their work location and schedule (Šmite et al., 2023b); and, (ii) companies are moving towards hybrid and remote work models to accommodate this need (Šmite et al., 2023a), as well as for other benefits like widening the talent pool (Šmite et al., 2022b).

The shift in work arrangements that is taking place has also already begun to affect organizational policies and the decisions of employers, as stated by Hensher et al. (2023), *"On the one hand, they [employers] need to work out the ongoing work arrangements and the support plan for working from home. On the other hand, they need to decide whether to maintain, increase or decrease, the existing workspace, or decentralize the workspace"*. Many companies such as Slack and Shopify are already implementing new remote work policies that require a radical reassessment of their office spaces, while other companies like Google and Microsoft are opting for a hybrid model where employees will work partly from the office, and partly from home (Stoller, 2021).[1]

In agile software development, the shift from work from home (WFH), to work from anywhere (WFX), has not yet been explored in depth. A recent systematic mapping study carried out by Khanna et al. (2024) on the topic of hybrid work in agile software development identified just 12 studies within this research area. Of these studies,

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[1] The flexible workspace platform Hubble provides an extensive overview of how over 40 of the world's most famous companies have approached their future workplace strategies in terms of either office-first, hybrid, or remote-first: https://hubblehq.com/blog/famous-companies-workplace-strategies. Accessed: 2023-10-19.

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seven discussed the work location arrangements of the teams, while only five specified their work schedule modes (Khanna et al., 2024). Experimentation in team work arrangements is most often accompanied by changes in the strategies and policies of companies (Šmite et al., 2023a), which warrants investigation of these policies. Therefore, this study aims to address this gap in the literature by investigating the evolution of work arrangements in agile software teams and organizational policies, and by analyzing their impacts at the organizational, leadership and management, and team levels.

We conducted a multiple-case study to explore the evolution of organizational policies and the work arrangements of 28 agile teams, from six companies, based on interviews with seven individuals in leadership and support roles. To unify the terminology of the team work arrangements, we utilized the team typology and multidimensional model proposed by Šmite et al. (2022a). We further extend the categorization to include the geographical location of team members, contributing to a more comprehensive conceptual framework for understanding the work arrangements of software teams. The research questions driving this study are:

- **RQ1:** *How have the work arrangements of agile software teams and the policies of companies evolved during and since the Covid-19 pandemic?*
- **RQ2:** *What are the effects of the evolving work arrangements?*

In the following, we will provide a brief overview of the background (Section 2), present selected literature (Section 3), and describe the research approach followed (Section 4) and the case companies (Section 5). We then present our results on the evolution of the organizational policies and the team work arrangements (Section 6) and their effects (Section 7). Finally, we discuss our findings (Section 8), threats to validity (Section 9), and provide concluding remarks (Section 10).

2. Background

2.1. Model for analyzing work arrangements

Creating any significant software requires the effort and cooperation of several people, a team. Traditionally two types of team work arrangements have been used to categorize software development in context: the traditional or collocated team, and the virtual team (Šmite et al., 2014). This categorization has allowed, for instance, to design practices like pair programming for teams sharing the same physical space (Hannay et al., 2009); to reason about the effects of geographical, temporal, linguistic, and cultural distance in the context of globally distributed virtual teams, as discussed by Herbsleb et al. (2001) and Noll et al. (2011); and to reflect on the idiosyncrasies that make a seemingly simple artefact like a task board so complex to replicate digitally (Esbensen et al., 2015).

However, since the pandemic new types of team work arrangements are surfacing that do not conform to the collocated or the virtual category. In this study, we adopt the team typology and multidimensional model proposed by Šmite et al. (2022a) (see Fig. 1) to categorize the work arrangements of agile software teams and to standardize the terminology.

The model is based on three core dimensions: *work location*, *work schedule* (Fig. 1, horizontal axis), and the degree of alignment within the team (Fig. 1, vertical axis). Along the work location dimension, team arrangements are categorized by the degree of alignment among members (Fig. 1, vertical axis). The model distinguishes between teams where all members work entirely **onsite** (*office mode*) or entirely **remote** (*remote mode*), and the defines **hybrid** only as those teams that have an erratic office presence with no alignment between members (*flexible location mode*).

It is important to note that while the term "hybrid" has been in use since the early 2000s (Halford, 2005), it has gained popularity since the pandemic. In recent literature, the term is often used to describe any combination of "remote and office" work (e.g., Conboy et al., 2023; Hopkins and Bardoel, 2023; de Souza Santos and Ralph, 2022). However, no clear consensus has been established, and definitions of hybrid vary widely. In this study, we use the definition proposed by Šmite et al. (2022a).

According to Šmite et al. (2022a), other team arrangements fall into two categories: **partially aligned**, which surfaces when members do not always align, or some members do not align; and **variegated**, which are distinguished by predefined but altering work locations. Within these two categories, the model identifies three archetypes: *semi-remote mode*, *office-remote mix mode*, and *semi-onsite mode* for partially aligned and *aligned office-first mode*, *aligned office-remote mix mode*, and *aligned remote-first mode* for variegated.

The model also categorizes work arrangements along the work schedule dimension, distinguishing four modes: *synchronous mode* with fully aligned work hours; *flexible mode* with erratic, uncoordinated work schedules; *core hours mode* with specific time overlaps, and otherwise flexible schedules; and, *core meeting mode* with alignment around scheduled meetings or events, and otherwise flexible schedules.

2.2. Classifying team distribution

Given that the team typology proposed by Šmite et al. (2022a) does not explicitly account for the geographical distribution of team members, this study extends the categorization by introducing the following classifications:

- *Collocated teams*: all members operate from the same physical location (Šmite et al., 2014).
- *Partially dispersed teams*: one or a few members are situated in different locations, compared to the majority who are based in the same physical location (Sharp et al., 2012).
- *Dispersed teams*: most or all members are distributed across various locations (Braithwaite and Joyce, 2005).

By including these additional classifications, we aim to provide a more comprehensive framework for understanding the evolving work arrangements of software teams.

3. Related work

A stream of research has been published on the effects of the pandemic in the IT industry in general, and in particular on developers and software engineering teams. Most of the recent studies on the topic were conducted during the pandemic in a forced WFH situation (Butler and Jaffe, 2021; Ford et al., 2021; Miller et al., 2021; Russo et al., 2021a; Šmite et al., 2023b). Two major foci of interest can be identified in these studies. First, numerous studies focus on metrics of developers. Under this category we find: developer productivity (Bao et al., 2022; Šmite et al., 2022c), productivity and well-being (Ralph et al., 2020; Russo et al., 2021b, 2024), and task satisfaction and performance (Russo et al., 2023). Second, multiple studies investigate specific technical practices, such as remote pair programming (Šmite et al., 2021), understanding non-functional requirements (Okpara et al., 2022), and consequences to the processes (Schmidtner et al., 2021). However, although briefly discussed in several of the above mentioned studies, team work arrangements have not been the focus, likely given the importance in the immediate pandemic period to understand the pressing consequences of the forced WFH condition.

Fewer studies yet focus on the schedule dimension of work arrangements, as identified in (Khanna et al., 2024). Of the five studies mapped by Khanna et al. (2024) which specify the work schedule of agile software teams, only one focuses on the topic. This study (Wang et al., 2022) took place during the intermediate pandemic period, with the first transitions to new work modes beginning in July 2022.

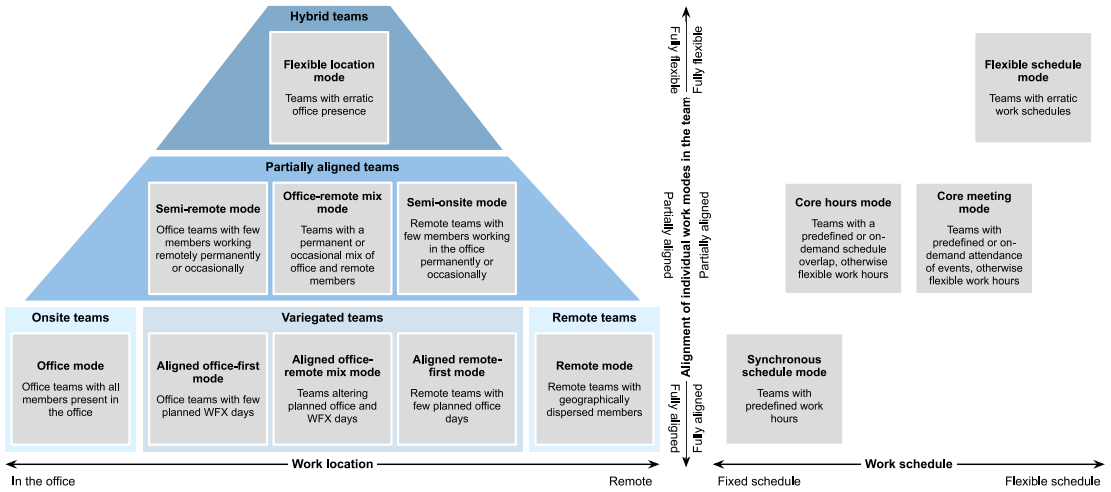

Fig. 1. Team typology and the spectrum of work arrangements (Šmite et al., 2022a).

Alignment on *core hours* during office days was implemented in the company, based on the outcome of workshops which were carried out as part of the co-design research approach. This alignment practice was considered one of the most essential adjustments to the work modes in participant feedback (Wang et al., 2022). These findings draw attention to the importance of the schedule dimension in work arrangements, and the need for research on this topic in agile software development.

3.1. Evolving policies and work arrangements

We identified only two studies in agile software development which provide insights on the evolution of work arrangements and organizational policies, prior to, during, and after the pandemic, which we present in the following. Moe et al. (2023) carried out a longitudinal study between 2018–2022 in a Norwegian company, which uses agile software development, with the aim of understanding how companies can retain talent. The work location of the employees is briefly described in connection with the insights about the company efforts to become and remain an attractive workplace. Prior to the pandemic most of the employees were collocated, with the exception of four distributed teams. During the pandemic, all the employees were forced to shift to remote work, followed by a mix of WFH and onsite work during the intermediate pandemic period.

Following the journey of software teams in 13 different software companies in New Zealand before, during, and after the pandemic, Masood et al. (2021) explored how productivity and flexibility was maintained. Key learnings and recommendations for employers and managers are also provided, for example, that agile ceremonies should be conducted on days where all team members are at the office. Similar to the work carried out by Moe et al. (2023), Masood et al. (2021) do not describe the exact work arrangements of the teams in detail, but do mention that work from the office was the most prevalent setting before the pandemic, and that the majority of the study participants worked from home in their preferred settings and timings during the pandemic. After the pandemic, the companies began introducing policies pertaining to the work settings, with some allowing the employees or their teams to decide where to work based on personal preferences. Few companies moved back to their initial setting of work from the office.

3.2. Workspaces

In seminal studies, "hybrid workspaces" were discussed as the way that information and communication technologies could be used to enable remote working and virtual organizations, defining these spaces as *"a combination of organizational and domestic spaces, mediated in cyberspace"* (Halford, 2005). Given the technological advances in the IT sector and the current use of online spaces for more collaborative work, in this study we define the workspace as: the combination of both the physical spaces, like the home and office, and the virtual spaces used by many software teams, such as Confluence,[2] and Jira.[3]

As organizations confront the evolving dynamics of work arrangements, the purpose of physical offices is being reevaluated (Vasel, 2020). A number of companies are trying to create flexible office layouts that enable the space to accommodate changes. Other initiatives range from a heightened emphasis on social and collaborative areas to foster opportunities for in-person socialization among locally remote teams, which is supported by for instance, Clear (2021) who highlights the advantages of enhancing social connections among team members, to the implementation of flexible seating office management strategies aimed at downscaling the workspace, which is in line with trends observed by other researchers, for instance, Fayard et al. (2021) and Appel-Meulenbroek et al. (2022).

Even though rapidly growing, only a limited number of studies can be found that research specifically these recent shifts in workspaces and work environments, such as, Watson et al. (2021), Hensher et al. (2023), and Maier et al. (2022). Even fewer studies research these topics in relation to agile software development specifically, such as Šmite et al. (2022b) who explored the office presence of employees during and after the pandemic in two agile software companies with hybrid work policies. The findings of Šmite et al. (2022b) showed that the office presence in both companies was below 50% after autumn 2021, resulting in half-empty office spaces. The authors also discuss the implications of this development, e.g., that companies might consider reducing or repurposing the office space, and suggest some potential practical solutions, including hot-desking, dividing onsite work into shifts, or renting out the office space on days with low attendance.

[2] Confluence: https://www.atlassian.com/software/confluence.
[3] Jira: https://www.atlassian.com/software/jira.

3.3. Agile software development during Covid-19

As previously mentioned, numerous studies on remote work in software development were carried out during the pandemic. In addition, we identified several studies which investigated agile software development specifically during the pandemic, which are directly related to this paper. In particular, Matos and França (2022) aimed to document the main practical challenges faced by agile software development teams during the pandemic, as they adapted to changing work norms. The authors report on the experience of five agile software development teams in Germany, Canada, and Brazil. Among the main challenges identified, the study found that the teams experienced a decrease in project awareness, due to a lack of spatial exposure. To compensate for this lack of awareness, employees in leadership roles needed to engage in constant proactive follow-ups.

Similar insights regarding some of the challenges experienced by leadership were also provided by Ågren et al. (2022), who investigated how agile practitioners were affected in their ways of working, due to the involuntary shift to remote work and the social restrictions imposed by the Covid-19 pandemic. Their analysis showed that changes in communication and meetings took place. Casual spontaneous conversations and face-to-face meetings were reduced in remote work, because overhearing what other people say or do was not possible. This affected in particular the work of agile coaches, who took measures to ensure that they stayed close as a team. To facilitate their work, many practitioners had also tried new tools, for example, replacing physical whiteboards with digital ones like Miro and Mural, and the use of tools had become more serious overall during the pandemic. In addition, several new processes were used to simulate a physical workplace, including the establishment of core work hours and the use of open video and audio channels that anyone could connect to during the work day.

The lack of face-to-face discussion in WFH is also discussed by de Souza Santos and Ralph (2022), in their year-long participant observation study which investigated the impact of working from home on agile software teams. Coordination within the teams was fundamentally altered as a result of the shift to WFH, and the authors found that group cohesion and new effective communication strategies and technologies appeared to help preserve coordination in the teams. Finally, Bablo et al. (2023) carried out an action research study of two scrum teams in Poland to investigate and adapt the teams remote work practices and processes, identify challenges and how they could be mitigated, and identify the advantages of remote work. Here, several study participants expressed that team members became less interconnected in remote work, which hindered creativity. In Section 8 we further discuss the insights provided by these studies in relation to our findings.

4. Research approach

4.1. Research design

The focus of this paper is to examine the evolution of organizational policies and work arrangements of agile software teams, based on the perspective of individuals in leadership and support roles. To capture the various stages of the pandemic and its impact on policies and work arrangements, we conducted an exploratory multiple-case study, following the guidelines of Yin (2018) and Verner et al. (2009). Using a convenience sampling strategy (Robson and McCartan, 2016) within the researchers' networks, six companies of different sizes and from different industry sectors were selected for the study, which provided higher chances of obtaining a rich and diverse range of organizational policies and team work arrangements. The companies are anonymized, so pseudonyms are used when referring to each company (i.e., Alfa, Bravo, Charlie, Delta, Echo, and Foxtrot). The design of the study is a holistic multiple-case (Yin, 2018, p.48), with each case limited to the teams investigated, while the organizational policies provide context for the cases. This research design enabled us to gain a deep understanding of the phenomenon within its specific context and draw meaningful insights from multiple perspectives.

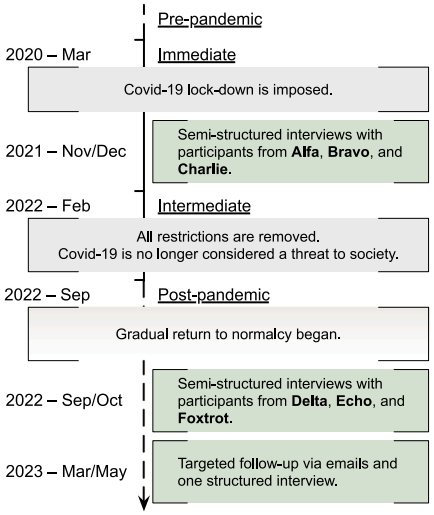

Fig. 2. Overview of the data collection activities. Visible are: the model proposed by Christakis (2020) (underlined), the instance of the model to the Danish context (gray background), and the breakdown of the main data collection activities (green background).

The research design was modeled around the Danish restrictions implemented during the Covid-19 pandemic[4] and the categorization of pandemic periods defined by sociologist Christakis (2020). According to Christakis (2020), pandemics like Covid-19 can be characterized by three periods: immediate, intermediate, and post-pandemic. By collecting data about the pre-pandemic, immediate, intermediate, and post-pandemic periods, we aimed to gain comprehensive insights into the changes that occurred over time. Fig. 2 provides an overview of both the data collection activities and the restrictions implemented in Denmark between 2020 and 2023.

We aimed to improve the understanding of the phenomenon by collecting "thick" (Storey, 2016) qualitative data through direct interviews with individuals in leadership and support roles. This technique was utilized based on the recognition that software development presents a number of unique managerial and organizational issues, which must be addressed and solved for the field to progress (Seaman, 1999). A large number of the reviewed related studies have, in contrast, primarily utilized "big" data (Storey, 2016), which has been collected via quantitative methods, such as large-scale surveys (Miller et al., 2021; Russo et al., 2021a) and by mining developers activities (Bao et al., 2022). By collecting thick data, we can investigate the complexity of the phenomenon and gain richer and more informative insights.

4.2. Data collection

The participants from the selected companies held leadership and support positions from a wide range of roles, which allowed us to capture a broad understanding of how the organizational policies and team work arrangements were perceived. Depending on the participant

[4] Covid-19 timeline in Denmark: https://www.ssi.dk/aktuelt/nyheder/2022/da-covid-19-ramte-verden-og-danmark-se-tidslinjen-her. Accessed: 2023-10-19.

Table 1
Company domain, participant and team demographics.

Company	Company domain	Participant role	Experience	Teams	Team size	Team domain
Alfa	Software (experience innovation)	CTO	15 years	7	10	Digital transformation
Bravo	Social media suite	PM director	8 years	1	6–8	Product development
Charlie	Software-as-a-service	Tech lead	1 year	1	5–7	Customer service platforms
Delta	Banking sector	Tribe coach	1 year	7	10–11	Financing solutions
Echo	Pay-tech solutions	Agile coach	4 years	8	Unknown	Product operations
Foxtrot	Logistics sector	Two SM's	1–2 years	4	6–12	Software development

position, we had access to information related to one or several teams. Table 1 shows the domain of the companies, the participant role and years of experience in the company, and the demographics of their teams, or the teams they support. Four of the participants (from Bravo, Charlie, and Foxtrot), worked directly with the teams in question as team members, while the remaining three participants held higher level leadership or support roles.

The interview protocol, which included the questionnaire, was planned in detail within the research team and can be viewed online in the supplementary materials (Christensen et al., 2025). The interview questions were designed by the research team to gain information from the participants on the evolution of the team work arrangements and organizational policies, based on the time periods characterized by Christakis (2020). The questions were also designed to elicit information about the effects of the evolution, potential differences between how the teams were working and what the companies dictated in their policies, and the profile of participants and the companies.

All the participants signed a written consent form which described the purpose and procedure of the study, how outcomes would be used, and steps taken to maintain confidentiality. The form also included a yes/no check-box stating interest in joining follow up sessions, which was ticked yes by all participants, except the one from Charlie. The interviews were carried out online via Zoom by one or two authors, and lasted 58 min on average. All interviews were video recorded with the permission of the participants. One of the interviews was carried out with two participants at the same time, at their request, which gave us access to insights from four different teams in the company (Foxtrot).

Regarding the timeline of the data collection and the Danish restrictions implemented during the Covid-19 pandemic (see Fig. 2), we considered the pre-pandemic period as the time before March 2020 when the Covid-19 restrictions had not yet impacted work practices. This was followed by the immediate pandemic period, spanning from March 2020 to January 2022, which was characterized by significant changes, such as mask mandates and the need to avoid crowded places. Towards the end of this period, in November and December 2021, three participants from three different companies (Alfa, Bravo, and Charlie) were interviewed for the study.

On February 1st 2022, Denmark declared Covid-19 no longer a threat to society and all mandates were lifted. We define the following seven months of 2022 as the intermediate pandemic period, when people were still in the process of recovering from the pandemic. By mid August 2022 the number of new Covid-19 cases had dropped significantly,[5] the test capacity had been scaled down to 10,000 daily tests, and only particularly vulnerable individuals were being offered vaccinations. Based on this timeline, the post-pandemic period began in September 2022, in which a gradual return to normalcy started, yet with the presence of persistent changes. This timeline differs slightly from the categorization defined by Christakis (2020), who proposed that we might not enter the post-pandemic period until 2024. At the start of this period, in September and October 2022, four participants from three additional companies (Delta, Echo, and Foxtrot) were interviewed.

[5] Drop in Covid-19 infection and positive test rates: https://www.ssi.dk/aktuelt/nyheder/2022/markant-fald-i-covid19-smitte-og-positivprocent. Accessed: 2023-10-19.

Given that the interviews were designed to be open-ended, gaps were present, primarily pertaining to the organizational policies and post-pandemic work arrangements. To better ensure consistency across the cases, these gaps were filled by contacting the six participants who had consented to joining follow-up sessions, between March and May 2023, with targeted questions via email, and the option to either respond via email, or participate in a follow-up interview. The two participants from Foxtrot opted for a structured follow-up interview, while the remaining four participants provided their responses via email.

Considering that we could not obtain follow-up information from the participant from Charlie, the data related to the last two periods in this case are based on the conversation about the planned evolution which were discussed during the interview, and were not confirmed in the later stages of research. This is emphasized in Fig. 7 with a dashed line. In addition, we were unable to obtain specific data from the Echo participant regarding the schedules of the eight teams, so this is not depicted in Fig. 9. Due to the dispersed nature of the teams, some of which were situated in different time zones, the participant was not privy to these details.

4.3. Data analysis

To code and analyze the data collected we used a codebook thematic analysis approach (Braun and Clarke, 2021), which involved alternating between inductive and deductive data engagement.

Phase 1 — Data familiarization: The interviews were transcribed verbatim with Avrio software, then manually reviewed by the first author to ensure consistency with the data and immersion (Braun and Clarke, 2006). At this point, the transcriptions were edited by including formatting, correcting spelling mistakes and transcription errors, and removing all names and personal details to maintain participant confidentiality. To enhance readability, excessive commas and filler words like 'uh' or 'um' have been eliminated from most of the quotations used in this study. Some of these filler words have been retained to better capture the natural flow of the conversation. This balance between authenticity and comprehensibility has been carefully considered during the editing process.

Phase 2 — Initial code generation: An initial light thematic analysis of the data collected in the first three interviews was then carried out by the first author, using NVivo Pro 12. Statements in the data were first coded, then clustered under several broad topics, i.e., artefacts and tools, distribution and scheduling, work space description, organizational policies, team practices, and social activities.

Phase 3 — Deductive data engagement: Following this initial inductive analysis, a deductive step was taken to unify the terminology used by the participants. Here, the team typology and the spectrum of work arrangements proposed by Šmite et al. (2022a) (see Fig. 1), was instantiated with the data from all of the interviews. We also extended the categorization to include the geographical location of the team members (*collocated*, *partially dispersed*, and *dispersed*). This allowed us to have a consistent view over the described evolution of the team work arrangements. This phase resulted in 15 deductively created codes, grouped under three topics (team distribution, work arrangement location, and work arrangement schedule).

Phase 4 — Code refinement and description: All of the interviews were then further analyzed by the first author and the initial codes pertaining

Table 2
Mapping of themes. The statements marked in gray text are incorporated in Sections 6 and 7, while the others provide additional evidence of the mapping process followed.

Theme	Code (s)	Refs.	Example of coded statement
Empty office spaces	Empty office	6	Bravo participant: *"I think the old environment was built to create a sort of good mood environment to work. You are happy to come to the office. Which obviously now it's more in the background and it's a bit ruined if you want, because it's an empty office at the end, and an empty room [. . .]"*
Policies impact the team physical workspace	Flexible seating	12	Delta participant: *"So we are not actually creating those small squad areas, because there's a free seating policy in general. And those two things sometimes collide with each other."*
	Hot desking	7	Echo participant: *"You have to book a desk. So, I used to say: Okay, I'm going to my team office every Wednesday, then I have booked a desk, so I know that I can sit next to them [. . .]"*
	Fixed seating	2	Alfa participant: *"[. . .] within the area, people are committing, saying: I come at least three times a week to the office and I would like to have a fixed seat."*
Workspace impacts creativity	Creativity	4	Delta participant: *"I truly believe that a collocated team is stronger than a distributed team, and that they can gain more. And more can be more creativity, more volume, better quality, or something like that."*
Shifts in communication	Communication tools	22	Charlie participant: *"So things that we didn't use before, that we used in the pandemic, I would say Zoom is of course the clear winner."*
	Privacy concerns	2	Bravo participant: *"I proposed at some point to, for example, create a Zoom room and keep it open all day. And then everybody would stay muted, and if you wanna say something, you can just say something. But they said no right away. They said it was too invasive."*
	Digital tools	22	Foxtrot participant: *"And we very quickly started to use Mural, Miro, all these [tools]. I remember there was a lot of debate going on. What's the best tools to use, right?"* [first interview]
	Physical tools	21	Foxtrot participant: *"If [the developers] are in the office, they will grab a whiteboard, hopefully. If they're online, then they agree: Okay, we have to wait, maybe we have to meet tomorrow and do this on a whiteboard."* [first interview]
	Connecting online	19	Charlie participant: *"I was talking to my team the other day about what you do new in Slack, that you didn't before. [. . .] sometimes I have these things spinning in my head and it's in a non-friendly time with the team, where if I write, I might disturb somebody [. . .]. So what I do is, I write it, but it's scheduled to send for the day after [. . .] So it's a win-win situation. I don't disturb and I get this load off my mind."*
Need for improved coordination	Coordination	6	Echo participant: *"They have a lot of meetings to make sure that they, as a team, are working well, and not forgetting one guy sitting in another country or at home. Many people also choose to stay at home, so they have a need to invite for more meetings, to get collaboration and understanding, and also celebrating stuff."*
Loss of awareness and need for proactiveness	Manager awareness	10	Echo participant: *"[. . .] it's more difficult to coach people, to help them, if we are not sitting next to one another. [. . .] [Before] I could sit next to the team. I could hear what they were actually struggling with, and then I could say: Hey guys, should we go in and draw on the whiteboard? Should we do this together? And it was much more easy."*
	Developer awareness	2	Alfa participant: *"Right now I think it's working fine. I mean, also the work from home, I actually think it's working quite fine. If we are talking about developers, I think they see less of a problem than some of the people that manages them, right?"*
	Glue in the team	3	Delta participant: *"I think the product owners are often, you know, the glue in a squad, you could say. They are sometimes having difficulties in collecting the team and gathering the team for long enough period in order to work with the team."*
	Proactiveness needed	7	Bravo participant: *"Now I'm scouting around the conversations on Slack to see if this is a problem, where I can provide support, or if this is something interesting for our team. [. . .] Now it's like I need to proactively cut time in my daily schedule to do this."*

to the organizational policies and the effects of the evolving work arrangements were refined and described in an iterative process. This phase resulted in 26 codes created inductively, which were grouped under two different topics (policy and effects of the evolving work arrangements). The final codebook containing all of the codes and their descriptions can be viewed online in the supplementary materials, along with an interview excerpt which provides a visual example of the coding process (Christensen et al., 2025).

Phase 5 — Theme identification: Finally, the codes pertaining to the effects of the evolving work arrangements were sorted into overarching themes. During this phase of the research, meetings led by the first author and attended by up to three authors were arranged on a regular basis, to discuss and clarify the understanding of the data. Three of the initial codes (i.e., empty office, creativity, and coordination) formed the basis for three main themes. The remaining codes were grouped based on shared meaning, forming three additional main themes. All of the identified themes were then defined and named. Table 2 provides an overview of the six themes, their corresponding codes, the number of references for each code, and an example statement from the data for each code. The statements marked in gray text in Table 2 are incorporated in Sections 6 and 7, while the others provide additional evidence of the mapping process followed.

Phase 6 — Follow-up data analysis: The follow-up data collected via email and one interview was added to the NVivo project at this stage, and the codes which had already been created were instantiated in the data. Because the follow-up data pertained almost entirely to the organizational polices and post-pandemic work arrangements of the teams, with only a few exceptions (for example, two of the participants were asked how many teams they supported), the applied codes fell primarily under those topics. None of the follow-up data was coded under the effects of the evolving work arrangements topic, and no new codes or themes were created during this step in the process.

5. Companies

Alfa is an international software agency with a focus on experience innovation. The company employs over 5000 people who are connected to 60 offices in 22 different countries. The company practices agile at scale and the software development teams customize their agile

approaches to fit the needs of the organizations they are working with and delivering products to. We interviewed one chief technology officer (CTO) with 15 years of experience in the company. At the time of the interview the CTO was responsible for seven teams, each of which had 10 members, who worked in the domain of digital transformation. Five of the teams were collocated in either Copenhagen or Aarhus. The two other teams were partially dispersed, with a few members in each team located in Ukraine and Poland respectively.

Bravo is a social media suite company employing over 1000 individuals, which provides consumer intelligence and social media management to their customers. The company has offices in 16 countries and follows agile practices. The software development teams work in two week sprints and use other elements of scrum, including daily stand-ups, sprint retrospectives, and sprint planning. The participant is a product management (PM) director with eight years of experience in the company, who works with one product development team. The partially dispersed team originally consisted of six members, with one member located in Bulgaria, while the remaining members were located in Copenhagen. During the intermediate pandemic period the team acquired two more additional members, who were located in Poland.

Charlie is a software-as-a-service company, which provides products related to customer support, sales, and other customer communications. The company employs about 6000 individuals and has offices in 25 different countries. The software development teams in Charlie use agile practices which are in line with scrum, but each team tailors the practices to their own needs. The participant is a tech lead working with one team, who has been working in the company for one year. The team developed customer service platforms and originally consisted of five members who were collocated in Copenhagen. During the intermediate pandemic period two more members located in Berlin were hired, changing the team distribution to partially dispersed.

Delta is in the banking sector and has more than 20,000 employees across their global offices. The company follows an agile approach which was originally built around scrum, but the software development teams are not restricted to the scrum framework and some of them have converged into other frameworks like kanban. The participant has been employed with the company for one year as a tribe coach for seven teams (squads), and acts as an agile ambassador for these teams. The teams consist of 10–11 members each, totaling 75 individuals, who are dispersed between Denmark, Lithuania, and India. The domain of the teams is financing solutions.

Echo is a provider of pay-tech solutions with a global presence, employing approximately 2400 individuals across 25 countries. The company emphasizes the importance of an agile mindset in their teams, and the participant is employed as an agile coach in a business unit, which involves working with IT development teams across the whole organization. The participant has four years of experience in the company, and they are actively engaged with eight software teams. The domain of the teams is product operations, and the members are dispersed between multiple locations, including Poland, Finland, Germany, Copenhagen, Oslo, Stockholm, and Mumbai.

Foxtrot operates within the logistics sector and employs a highly diverse workforce of approximately 9000 employees. The company has adopted an agile approach in their software development and mainly follow scrum. During the interview process, two scrum masters, each with 1–2 years of experience at the company, were interviewed simultaneously. Both participants are actively engaged with two separate software development teams belonging to the same department. The four teams have between 6–12 members each, and two of them are collocated in Copenhagen. One of these teams has members in Sweden who, prior to the pandemic, commuted to the Copenhagen office on a daily basis. The other two teams are partially dispersed with the majority located in Copenhagen, while one member from each team is located in the Netherlands and Mexico respectively.

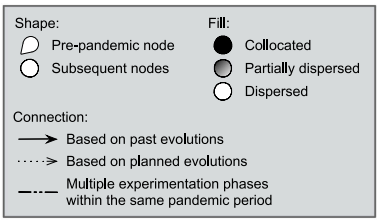

Fig. 3. Description of the iconography used in the instances of the cases, which captures time, distribution, and source of the evidence.

6. Policies and work arrangements

In the following section we provide the results to RQ1: *How have the work arrangements of agile software teams and the policies of companies evolved during and since the Covid-19 pandemic?*

For each of the six companies that took part in our study, we first describe the evolution of the organizational policies; followed by the evolution of the team work arrangements; and the instance of the framework proposed by Šmite et al. (2022a) visualizing the evolution. A description of the iconography used in the instances of the cases is provided in Fig. 3. We conclude the section by providing a brief summary and comparison of the work arrangements (Section 6.7).

6.1. Alfa

Policies: The philosophy at Alfa is that they would *"rather be more together than apart"* [interview], and preferably at the office. Prior to the pandemic there was an informal rule that employees could WFH one day a week, but this option was rarely used. Regarding the schedule, employees were expected to be at the office 7–8 hours per day, between 8:00–17:00. During the immediate period, the company shifted to remote work and the schedule became more flexible, allowing employees to work whenever they wished, so long as they did so in accordance with the needs of their teams. At the start of the intermediate period, the policy around the work location at Alfa was referred to as *"freedom with responsibility"* [interview], but the company did enforce work from the office on an ad hoc basis for specific teams and team members based on, for example, project deadlines. The policy regarding work hours remained the same as throughout the pandemic. At present, the policies regarding both work location and schedule remain largely unchanged.

Work arrangements: As shown in Fig. 4, prior to the pandemic the five collocated teams worked in *office mode* from the Copenhagen or Aarhus offices. One of the partially dispersed teams also worked in *office mode*, as the members in Denmark and Ukraine worked onsite in their respective offices (Fig. 5). The remaining team was partially aligned in *semi-remote mode* as the members in Poland worked from home (Fig. 5). All of the teams worked primarily in *synchronous schedule mode*, within the defined company hours. During the immediate pandemic period all seven teams switched to *remote mode*. As Fig. 5 shows, the majority continued working in *synchronous schedule mode*. However, some teams did switch to *core meeting mode* during this period (Fig. 4).

The intermediate period was characterized by a return to working in either *office mode* or *semi-remote mode*, while the team schedules remained unchanged. However, some of the teams that originally worked onsite in Copenhagen were now also partially aligned, and worked in *semi-remote mode* on occasion (Fig. 4), because the company permitted most team members to WFH according to their wishes. After the initial influx of people returned to working in the Copenhagen office, a large number fell back into working primarily from home, so the work arrangements of these teams shifted also from *office mode* to *semi-remote*

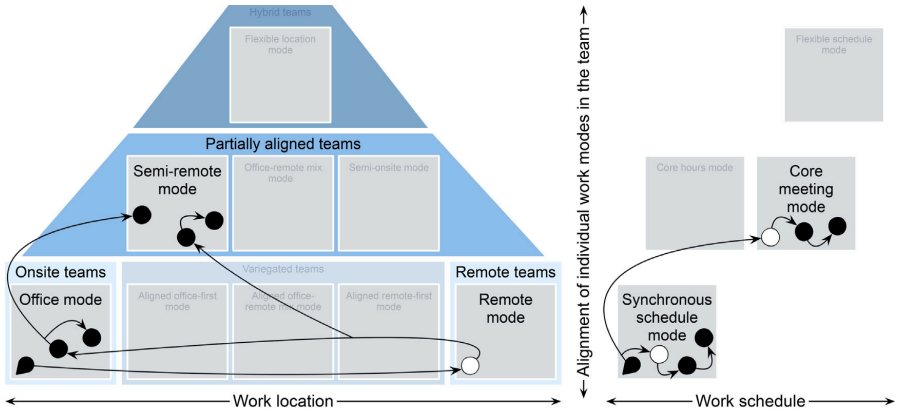

Fig. 4. Evolution of work arrangements in Alfa. Teams 1–5.

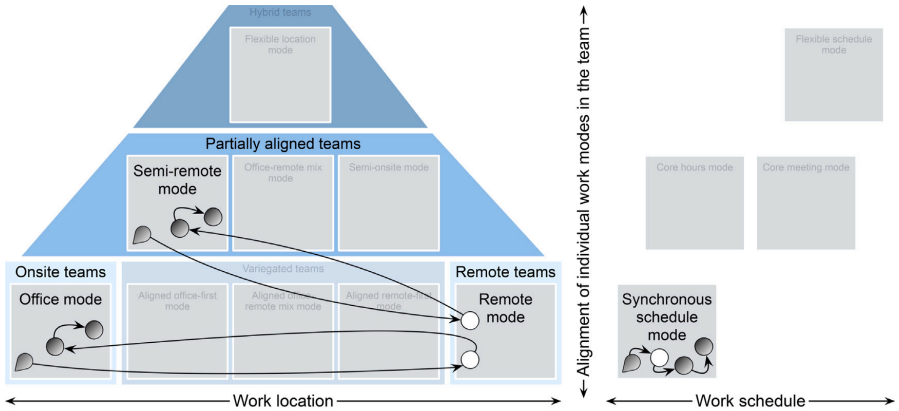

Fig. 5. Evolution of work arrangements in Alfa. Teams 6–7.

mode (Fig. 4): *"We saw many people initially coming back, then falling back into primarily working from home"* [follow-up email]. The current work arrangements in Alfa remain largely unchanged.

6.2. Bravo

Policies: Prior to the pandemic, the policy at Bravo was to work from the office, but some exceptions were permitted for individuals to WFX. The company also had fixed working hours between 9:00–16:00, with some flexibility. For example, employees could start an hour earlier and finish an hour earlier. The policy around working hours did not change throughout the time frame investigated.

During the pandemic, the company shifted to remote work. In the following intermediate period, the office was opened with a 50% capacity mandate, and employees were required to book office spaces in advance, but the company did not impose a return to office policy. The organizational policy currently remains focused on a WFX approach. Employees have the flexibility to choose their preferred work location on a daily basis, either at the office or from home, based on their personal preferences and needs. Consequently, a significant number of employees in Bravo opt to continue working remotely: *"Many people keep working from home for convenience"* [follow-up email]. However, one restriction is in place: employees cannot work from outside the country where they are hired for periods exceeding a few weeks per year. The requirement to book a table was also removed in April 2023.

Work arrangements: As shown in Fig. 6, prior to the pandemic the partially aligned team worked in *semi-remote mode* with the majority of members working from the Copenhagen office, while one member worked remote. The team switched to *remote mode* during the immediate period and continued this arrangement in the following intermediate and current post-pandemic periods. The work schedule of the team was fixed throughout the entire time frame, in accordance with the organizational policy, placing the team in *synchronous schedule mode* (Fig. 6).

6.3. Charlie

Policies: Prior to the pandemic, there was an unwritten but well established rule at Charlie that employees could WFH on Wednesdays if needed, but otherwise work had to be carried out from the office. Regarding the schedule, employees were expected to arrive at the office and begin working latest at 9:30. During the pandemic, the company shifted to remote work and permitted employees to work whenever they liked. At the end of the immediate period, the organizational policy transitioned to remote work, with exceptions permitted for employees who could not WFH. At the time of the interview, the

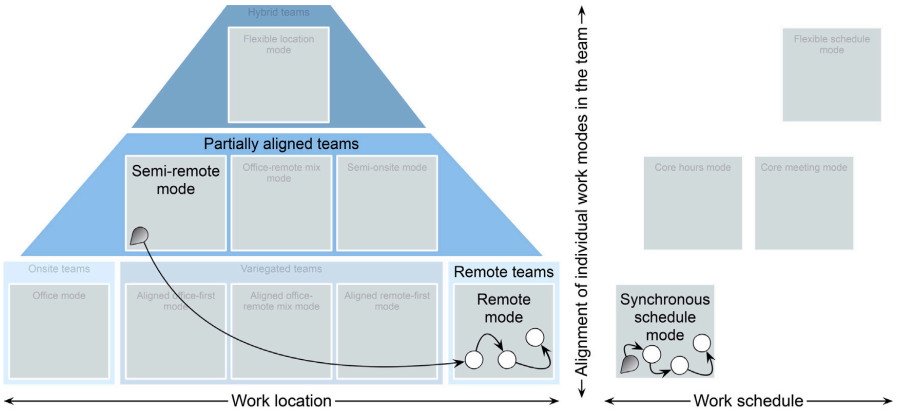

Fig. 6. Evolution of work arrangements in Bravo.

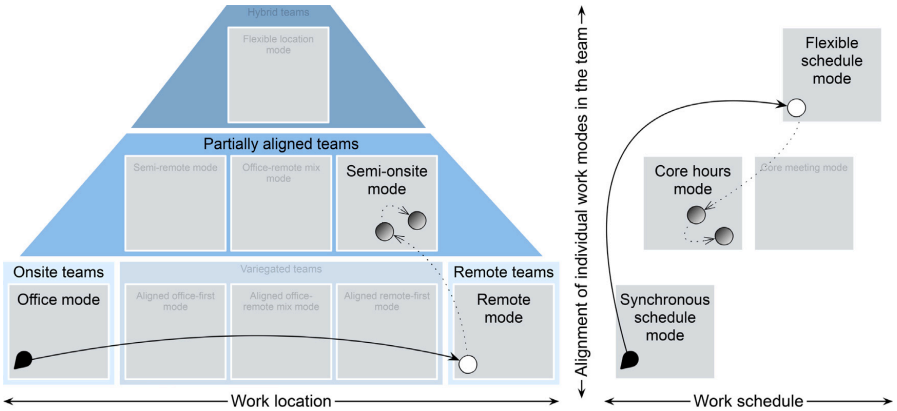

Fig. 7. Evolution of work arrangements in Charlie. Dashed line indicates unconfirmed data point.

company was discussing changing their policies to formalize the work schedules and location by designating specific office days: *"So you can work remotely, whenever. But it is being talked about a future rule of mandating people to be in the office at least a couple of times a week"*. We presume these policies were implemented in the intermediate period, shortly after the interview, and are currently in place.

Work arrangements: As shown in Fig. 7, prior to the pandemic, the onsite team worked collocated in *office mode* from the Copenhagen office, and was fully aligned in *synchronous schedule mode*. During the immediate pandemic period, the work location arrangement switched to *remote mode*, and the schedule to *flexible schedule mode* (Fig. 7). In the interview future agreements within the team were stated, where all the members would align their work schedules to achieve some overlap, and the members in Copenhagen would align on specific office days: *"So we were talking about identifying [...] a core time slot for the team. Like everybody has to be available from, I don't know, 10:30 to 3:00. [...] and designate one day of the week where we will attempt to be in the office together [...] If you have one day as a reference, you know that people will try to stick with it. So that's something that we will try to do"*. Based on the previously mentioned changes to the organizational policies and the statements from the participant regarding the future team agreements, the work arrangements would have shifted in the intermediate period from remote to partially aligned, in *semi-onsite mode*, with *core hours mode*, with these arrangements continuing in the following post-pandemic period.

6.4. Delta

Policies: Before the pandemic, Delta had a policy that required employees to work 37 h per week exclusively from the office. During the immediate pandemic period, all employees were told to WFH in compliance with government guidelines. Nonetheless, there were provisions allowing five percent of employees to work from the office during certain periods within this pandemic phase. In the intermediate period, the official organizational policy shifted to promote flexible work arrangements. A general guideline was established for employees to spend three days a week at the office, and two days working from home, which currently remains in effect. It is worth noting that within individual departments, local rules may apply, providing some flexibility and autonomy in defining specific work arrangements.

Work arrangements: Before the pandemic all seven teams worked onsite in *office mode*, albeit from different geographical locations (Fig. 8). During the pandemic, the teams shifted to a *remote mode* work arrangement. In the intermediate period, the teams switched to flexible work arrangements in accordance with the organizational policy, and they currently maintain this arrangement, placing them in

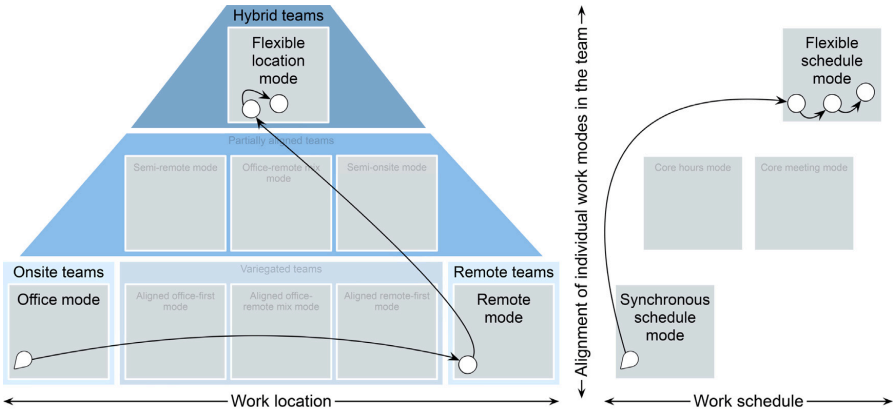

Fig. 8. Evolution of work arrangements in Delta. Teams 1–7.

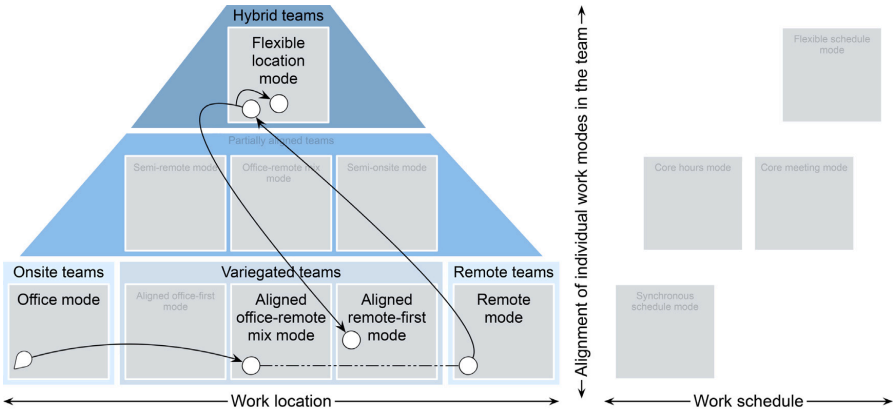

Fig. 9. Evolution of work arrangements in Echo. Teams 1–8. Dotted line indicates two stages of evolution during the pandemic.

flexible location mode and classifying them as hybrid teams. The teams in Delta often work two days a week at the office, primarily Tuesdays and Thursdays, but this is very much in the context of each team and there are no formal agreements: *"So it's a big mix and we are getting some learnings right now as to how that functions"* [interview]. However, the participant noted in the follow-up email that since the intermediate pandemic period there has been a growth in people wanting to work from the office.

Regarding the work hours, before the pandemic the teams worked in *synchronous schedule mode* (Fig. 8). However, given that the teams are dispersed across multiple locations and time-zones, the exact working hours could differ, so all team members might not have been working from the offices at the same time. During the pandemic, the teams shifted to *flexible schedule mode*, and this remains unchanged.

6.5. Echo

Policies: Prior to the pandemic, the primary policy at Echo was that employees worked from the office. However, when needed and agreed with management, there was an option for individuals to WFH on occasion. At the start of the pandemic employees were split into two groups, which alternated working from home every other week. Following this, all employees apart from critical functions were instructed to WFH, in accordance with the Danish restrictions. If an individual needed to go to the office, they were required to obtain permission from a manager. During the intermediate period no organizational policies were provided regarding the work location of employees, so they were allowed to WFH. Only some functions were required at the office because of criticality and the nature of the work. At present the company does not yet have any policies regarding the work location of employees. Regarding work schedules, the policy at Echo was described in the follow-up email as *"very flexible"* throughout the entire time frame.

Work arrangements: Before the pandemic, the work location arrangement of the eight teams was best described as *office mode* (see Fig. 9), i.e., all team members worked onsite from the office in their respective city every day, with only a few exceptions on occasion. During the immediate pandemic period the teams first switched to variegated and worked in *aligned office-remote mix mode*, due to the policy of alternating working from home and from the office. However, they all moved to *remote mode* later in the pandemic, as indicated via the dotted line in Fig. 9. Immediately after the pandemic, teams had no alignment on their work location, placing them in *flexible location mode* and classifying them as hybrid teams. Currently, some teams

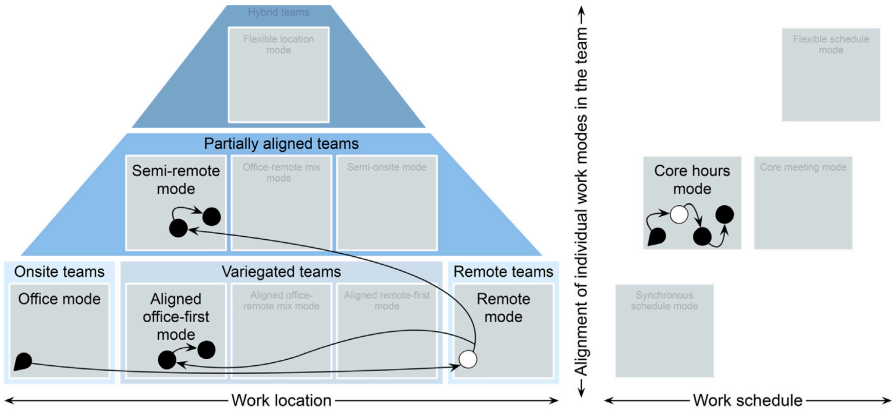

Fig. 10. Evolution of work arrangements in Foxtrot. Teams 1–2.

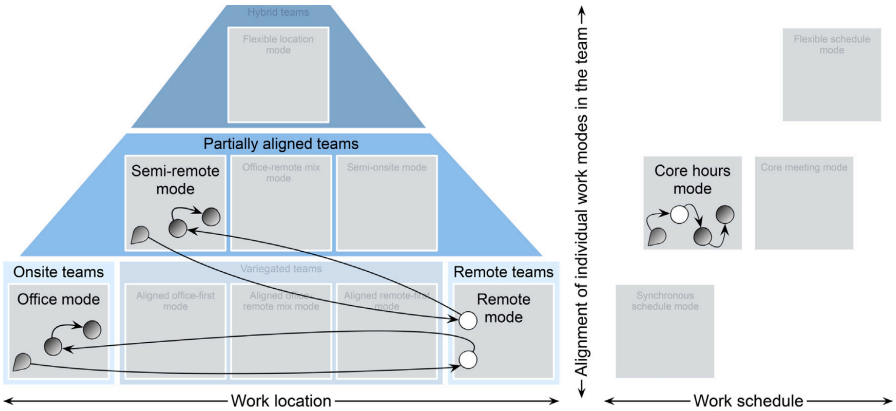

Fig. 11. Evolution of work arrangements in Foxtrot. Teams 3–4.

may align on a few specific days to be in the office (*aligned remote-first mode*), classifying them as variegated, while others maintain their hybrid status and do not align (*flexible location mode*).

Throughout the entire time frame, the team work schedules have been largely dependent on the particular distribution of each individual team. Given that the teams are dispersed and may be situated in different time zones, the arrangements are agreed on internally by team members, and could not be specified by the Echo participant: *"It all depends on how each team agrees to work according to their locations"* [follow-up email].

6.6. Foxtrot

Policies: Before the pandemic, the employee handbook at Foxtrot stipulated that employees were expected to work from the office, with some flexibility. If employees needed to WFH for a day, they were required to provide a concrete reason for this: *"So in our handbook it was formalized, the primary workplace is the office [...] We have flexibility, but you have to agree with your manager, agree in your teams"* [first interview]. During the immediate pandemic period, the company swiftly transitioned to a fully remote policy. In the first stages of the intermediate pandemic period, management initially expressed their desire for all employees to return to the pre-pandemic practice of working exclusively from the office. However, this policy was met with resistance, as many employees had experienced the benefits and flexibility of remote work. After considering the feedback and concerns raised by employees, management eventually arrived at a compromise, abiding by the concept of "flexibility" stipulated in the handbook, which allowed employees to combine both remote and office-based work. The policy around the work hours of employees only stipulated that they should spend eight hours working per day, but did not dictate the scheduling of those hours. This remained constant throughout the entire time frame.

Work arrangements: Prior to the pandemic the two collocated teams (Fig. 10), and one of the partially dispersed teams (Fig. 11) worked solely onsite from the offices in their respective locations, placing these teams in *office mode*. As shown in Fig. 11, the majority of members in the fourth team worked from the Copenhagen office, while one member worked from home, placing this team primarily in *semi-remote mode*. The WFH member did however go to the office in Copenhagen one week per month to work collocated with their team, so on these days the team worked in *office mode*, which would classify the team as primarily partially aligned, but occasionally fully aligned.

During the immediate pandemic period all four teams transitioned to *remote mode*. In the following intermediate period one of the collocated teams returned swiftly to primarily working from the office, with

only a few aligned WFX days, placing this team in *aligned office-first mode*, and classifying them as a fully aligned variegated team (Fig. 10). They currently maintain this work arrangement. The second collocated team transitioned to a partial alignment in *semi-remote mode*, with the members from Sweden coming to the Copenhagen office twice a week, an arrangement which they also currently maintain (Fig. 10). The two other teams returned to their original work location arrangements, *office mode* and *semi-remote mode*, and currently continue working in these arrangements (Fig. 11).

The work schedule arrangement of the four teams during the entire time frame is best described as *core hours mode* (Figs. 10 and 11), given that they all align closely on specific time slots where they work together as a team or attend meetings like retrospectives, but otherwise have flexible working hours in accordance with the organizational policies.

6.7. Summary and comparison of work arrangements

In the six companies, all of the 28 teams worked either in *office mode* or *semi-remote mode* prior to the pandemic. When the pandemic began 20 of the teams switched immediately to *remote mode*. In contrast, the eight teams from Echo switched first to *aligned office-remote mix mode*, before shifting to *remote mode*.

In the following intermediate and post pandemic periods, only four of the partially dispersed teams returned to their original work location arrangements (Alfa: teams 6–7, and Foxtrot: teams 3–4). Interestingly, the work location evolution of these four teams is identical in both companies, as can be seen in Figs. 5 and 11. Of the five collocated teams from Alfa, some did also return to *office mode* in the intermediate pandemic period, and maintain this arrangement, while others shifted to a partial alignment in *semi-remote mode* post-pandemic. The remaining teams from Alfa all shifted directly from *remote mode* to *semi-remote mode* and maintain this arrangement. A similar split between the teams could also be seen in the two collocated teams from Foxtrot, with one team shifting from *remote mode* to *aligned office-first mode*, while the other shifted to *semi-remote mode*.

The two teams from both Bravo and Charlie continued working remote in the intermediate pandemic period, but only the team from Bravo currently maintains this work location arrangement. At the time of the interview the team from Charlie discussed shifting to a partially aligned arrangement in *semi-onsite mode*, and if this unconfirmed data point is accurate, then this is the only team working in that particular mode. Finally, the 15 teams from both Delta and Echo shifted to *flexible location mode* in the intermediate pandemic period, and all seven teams from Delta maintain this arrangement post-pandemic, while some of the teams from Echo have shifted to a fully aligned arrangement in *aligned remote-first mode*.

Regarding the work schedules, no data was provided by the participant from Echo, so the eight teams from that company are not discussed in the following part of this summary. At least three of the teams from Alfa, the team from Bravo, and all four teams from Foxtrot did not adapt their work schedule arrangements during the time frame studied. The remaining teams from Alfa shifted only once from a fully aligned synchronous schedule, to a partial alignment in *core meeting mode*. The eight teams from Charlie and Delta shifted also once from a synchronous schedule, but to a fully flexible one instead.

At the time of the interview the team from Charlie had also discussed shifting to a partially aligned schedule arrangement in *core hours mode*, and if this unconfirmed data point is accurate, then this is the only team that experienced more than one shift in their work schedule arrangement. Interestingly, for all of the teams that did shift their work schedule, this took place simultaneously with the shift to *remote mode*, at the start of the immediate pandemic period.

7. Effects of the evolving work arrangements

In answering RQ2 (i.e., *What are the effects of the evolving work arrangements?*), we present the themes identified in our analysis, which revealed effects at the level of the company, the teams, and leadership and management.

7.1. Effects on the company

Empty office spaces: Our analysis revealed that there are a number of instances where the team office space is largely empty. This was mentioned by the participants from three of the six companies, namely the participants from Bravo and Echo, and one of the participants from Foxtrot.

The participant from Bravo describing the current office said: *"I think the old environment was built to create a sort of good mood environment to work. You are happy to come to the office. Which obviously now it's more in the background and it's a bit ruined if you want, because it's an empty office at the end, and an empty room [...] I personally had multiple conversations about this topic with colleagues: What do we do with the space we got? Shall offices be re-modeled? Shall we downgrade?"* [interview]. A similar description was provided by one of the participants from Foxtrot: *"We have this super new, nice headquarters, so it would be a little bit weird to say, just work from home. We just rented a super nice place, which is empty now"* [first interview].

This position is also shared by practitioners who are members of distributed teams. For instance, the participant from Echo, described their experience in the interview stating that *"[now] I often don't have a reason to come to the office in [location] where I'm connected to, because I don't have anybody there that I work with. So most of, or all of my time during the day is actually remote meetings with people all around the world. [Before] you entered the office and people were there. There was a lot of, you know, energy and atmosphere, and it was also easier to go to someone to talk. Now it is only emails and chat. In the old days, if you were sitting next to the guy [...] I would just turn to him and ask. What can you do now? Send a chat. [...] So I think there was more going on, energy and stuff like that, prior. Now you can enter an office, and practically no people are there"*.

The participant continued, by describing active measures they take to reduce the risk of coming to an empty office: *"When I go to our office in [location], I ask around before I plan. If I'm going Thursday, I write to people: Hey, do you plan to come to work Thursday? Because if you don't, why should I come? So, yeah, it's more dead now, actually more silent"*. Once brimming with activities, the physical premises of companies are currently oftentimes empty, creating a reinforcing cycle where employees interested in working from the office find themselves in empty rooms, as discussed by the participants from Bravo, Echo, and Foxtrot.

7.2. Effects on teams

Policies impact the team physical workspace: During the pandemic, four of the six companies (Alfa, Charlie, Delta, and Echo) implemented check-in systems and different seating arrangements (e.g., hot desking) in the offices to limit the number of employees working at the same time. In the interview with the participant from Delta, it became very clear how a policy such as this can prevent a team from having an effective workspace: *"[...] when you work agile and when you work with your team, if you're talking physically, you would like to set up a squad space, right? A home for your squad, for your team, where you can, you know, build your stuff, create your own cave, and create your own identity with the squad. But [Delta] has a policy saying there's free seating. So we are not actually creating those small squad areas, because there's a free seating policy in general. And those two things sometimes collide with each other"*.

A similar sentiment was also voiced by the Echo participant: *"So the other day I was out there and I was sitting in a group of four desks together with one of my colleagues, and two people I don't know anything about. So I also disturbed them a little bit, because when I was talking to my colleague, we were talking across the desk. And then you have two other people just sitting there and working on something else. Um, but then you meet new people, right? But you don't have a close collaboration with them"* [interview]. With the rise of team arrangements that are more fluid in terms of work location, and the extensive experimentation being done on the policy level of companies, it is now neither well defined nor well understood what the requirements are for an effective team workspace.

Workspace impacts creativity: Three of the participants (from Bravo, Delta, and Foxtrot) also discussed the impact of the workspace on the creativity of the team. Possibly rooted in prior and more long-standing experience with physical workspaces, some consider a co-located setup superior, as stated for example by the participant from Delta: *"I truly believe that a collocated team is stronger than a distributed team, and that they can gain more. And more can be more creativity, more volume, better quality, or something like that"* [interview].

Conversations about creativity, in connection with the work location, took place in the teams from Foxtrot, as one participant from the company stated: *"We [the teams] also talked a lot about where do I actually feel most creative? Where do I feel most productive? And there's some developers who just say: I'm definitely more productive at home, but I'm more creative at work, because then I can just grab someone and go to the whiteboard and quickly draw something"* [first interview]. This specific scenario, comparing the physical workspace with the virtual, was also discussed by the participant from Bravo: *"At some point we transform everything to tasks in Jira [. . .] So that's the boring flat list of stuff. But the more creative part happens in Miro. Before it was maybe a whiteboard, if we could. So, it would be, you know, pen, which I still find better"* [interview].

Shifts in communication: The participants from four of the six companies (Alfa, Bravo, Charlie, and Foxtrot) reported that the use of communication tools changed significantly during the pandemic. While tools such as Slack and Teams were previously used by the teams, they have been, and currently are, used much more extensively. Not only has the frequency in utilization of these tools changed, but Slack and Teams are also being used in novel ways, e.g., recording more meetings, utilizing more channels, integration with other apps, notifications, and delayed message delivery.

In contrast, the participants from Delta and Echo reported that the use of communication tools had not changed much during the pandemic, and attributed this to the dispersed nature of the software teams. However, both participants did report that the various tools were used more heavily. The participant from Delta also mentioned that there was a learning curve involved for team members who were more recently onboarded, compared to those who had been working in the company previously.

Both benefits and challenges were cited by the participants in relation to these shifts in communication. Citing the benefits, team members have learned to communicate more precisely in their written messages, and have resorted to private conversations to avoid disturbing the rest of the team or other employees in the office. Another benefit that was underlined by several participants is the ability to communicate both synchronously and asynchronously, without disturbing other team members.

Regarding the challenges, the use of video calls specifically was discussed in terms of the need for team members to become comfortable with this form of communication, and the perceived impact on their privacy, as stated by the participant from Delta: *"I think it was like three or four months ago that people still had to get used to being on video. [. . .] And still we meet people that are not comfortable in having their video on, and think that they're sharing too much of their private life with having video on. Or they can't navigate the screen and the camera at the same time, and stuff like that. So that's one of the areas that's challenging for some"* [interview]. This particular challenge was also discussed by the participant from Echo: *"I can be in a meeting or training with people from India where I look into a black screen, because nobody turns on their camera"* [interview].

Similar concerns surrounding the privacy of team members when working from home was also discussed by the participant from Bravo: *"I proposed at some point to, for example, create a Zoom room and keep it open all day. And then everybody would stay muted, and if you wanna say something, you can just say something. But they said no right away. They said it was too invasive"* [interview].

Need for improved coordination: The topic of coordination was discussed by participants from three of the six companies (Alfa, Bravo, and Echo). Here, the participant from Alfa mentioned that the teams needed to coordinate more during the pandemic to make sure everyone could attend meetings, and the participant from Echo discussed how more meetings were needed to ensure good collaboration in the team: *"They have a lot of meetings to make sure that they, as a team, are working well, and not forgetting one guy sitting in another country or at home. Many people also choose to stay at home, so they have a need to invite for more meetings, to get collaboration and understanding, and also celebrating stuff"* [interview]. The participant from Bravo also explained how some team members coordinated internally about when to show up in the office together, not only to work, but also to strengthen social ties in the team: *"So maybe three or four members of the team go to the office the same day, so they can meet. Maybe even if they don't need to necessarily work together, but it's more about seeing each other"* [interview]. These findings show that when it comes to the physical separation that is present in hybrid and remote work arrangements, teams are recognizing the importance of designing specific practices to improve team coordination, like holding more meetings and aligning their office co-presence.

7.3. Effects on leaders and managers

Loss of awareness and need for proactiveness: Interestingly, participants from four of the six companies (Alfa, Bravo, Delta, and Echo) discussed how the work in hybrid, partially aligned, variegated, and remote work arrangements can be challenging from a leadership and managerial perspective, and leads to a lack of awareness and a need for more proactiveness. This particular challenge was discussed by the participant from Echo in relation to coaching the teams: *"[. . .] it's more difficult to coach people, to help them, if we are not sitting next to one another. [. . .] [Before] I could sit next to the team. I could hear what they were actually struggling with, and then I could say: Hey guys, should we go in and draw on the whiteboard? Should we do this together? And it was much more easy"* [interview].

A similar point was also mentioned by the participant from Bravo: *"Personally, when I saw that two people talking, if I see that it's going on for more than X amount of time, if I was wearing [headphones], I would put them down and listen, and see if there was something interesting. [. . .] For me it was very important, because I was kind of the glue in the team and making sure there was good circulation of information. [. . .] And something else that I miss the most from the collocated environment is the random chats [. . .] this was a very good way to avoid meetings because just in five minutes you provided feedback to something that somebody else is discussing and you might get a solution right away. [. . .] Now I'm scouting around the conversations on Slack to see if this is a problem, where I can provide support, or if this is something interesting for our team. [. . .] Now it's like I need to proactively cut time in my daily schedule to do this. So I lose stuff, I lose information here and there"* [interview].

The participant from Delta also voiced this challenge, specifically from the point of view of the team product owners, which differed from that of the developers: *"I think the product owners are often, you know, the glue in a squad, you could say. They are sometimes having difficulties in collecting the team and gathering the team for a long enough period, in order to work with the team. So, I mostly heard from them saying: Ah, please guys,*

could you come to the office so we can, you know, be a team, be a squad, together? [. . .] Whereas the typical developer, he or she doesn't really need it. They can work from anywhere" [interview].

Similarly, the difference in perspectives between developers and managers was described by the participant from Alfa: *"Right now I think it's working fine. I mean, also the work from home, I actually think it's working quite fine. If we are talking about developers, I think they see less of a problem than some of the people that manages them, right? And that I do understand, because it is different having physical interaction, than it is, even if it's on Teams and video and all these different kind of things. It's another thing being with the person, and you get another level of the perception on all the small things and details"* [interview].

These findings show that team leaders and managers do not have the same oversight in hybrid, partially aligned, variegated, and remote work arrangements as they did prior to the pandemic, when all or the majority of team members were working from the office. The resulting lack of awareness forces them to proactively reach out to team members via communication channels, and use these channels to find issues the team may be dealing with, or discover other ways they can support the teams. According to two of the participants (from Delta and Alfa), this stands in contrast with the experience of the team developers, who don't perceive this to be a challenge.

8. Discussion

Terms such as flexible work, remote first, hybrid work, and WFX have become part of everyday vocabulary. However, as is often the case in software engineering, these terms are frequently used imprecisely or inconsistently. To address this ambiguity, Šmite et al. (2022a) proposed a team typology and a spectrum of work arrangements to promote the use of precise terminology. In this study, we adopt their framework to analyze the evolution of work policies and arrangements experienced by 28 software teams across six companies over the past three years, based on interviews with seven individuals in leadership and support roles.

In the following, we first discuss this evolution in connection with RQ1, then discuss multiple effects of the evolution in connection with RQ2. Finally, we identify practical implications and highlight future directions for research that emerged from this study.

8.1. Evolution of work arrangements and policies

Pivotal to our investigation was RQ1: *How have the work arrangements of agile software teams and the policies of companies evolved during and since the Covid-19 pandemic?*

We can report that the pandemic and the forced WFH situation certainly triggered the first shift from traditional *office mode* to *remote mode*, which was observed in all of the agile teams. This shift from onsite to remote work instigated by the pandemic restrictions took place across the entire IT sector, as is observed in numerous studies, for example, Moe et al. (2023), Masood et al. (2021), Ågren et al. (2022), and de Souza Santos and Ralph (2022). In our cases, this initial shift was followed by an evolution into several different modes ranging from *flexible location mode*, to more aligned ones like *semi-remote mode* and *aligned remote-first mode*. The only mode from Šmite et al. (2022a) that was not present in the cases included in this study was *office-remote mix mode*.

Work schedules also evolved, shifting from traditional *synchronous schedule mode* to more flexible ones. However, for most teams, this transition occurred at the onset of the pandemic, with no further changes. Notably, only one team (from Charlie) continued to adapt their schedule beyond this initial shift. In this instance, the team adopted a *core hours mode* during the intermediate pandemic period to improve predictability, while still preserving the flexibility introduced by organizational policies regarding in-office work. This additional adjustment is particularly noteworthy, as much of the post-pandemic research on work arrangements has emphasized location over schedule, a gap highlighted by Khanna et al. (2024). The evolution of the schedule which took place in Charlie has distinct similarities with the transition described in Wang et al. (2022), both in terms of the team schedule and the implementation of policies at the company level. While we were unable to determine the outcome of the evolution in Charlie, the practice of aligning on *core hours mode* was considered essential by the agile practitioners in Wang et al. (2022), and future research would benefit from exploring this topic further.

In addition to utilizing the team typology proposed by Šmite et al. (2022a), we aimed to further extend the conceptual framework by classifying the teams according to their geographical distribution (*collocated, partially dispersed*, and *dispersed)*. This additional classification revealed interesting patterns among the teams, which would otherwise not have emerged. Our findings showed that among the teams that were collocated in *office mode* prior to the pandemic, very few returned to this arrangement after the pandemic — observed only at Alfa. The vast majority of the originally collocated teams shifted instead to a partially aligned arrangement in *semi-remote mode* (Alfa and Foxtrot). In contrast, all of the partially dispersed teams in these two companies followed the exact same pattern in their evolution, reverting to their original work location arrangements after the pandemic (see Figs. 5 and 11).

Regarding the evolution of the organizational policies, three of the companies (Bravo, Echo, and Foxtrot) stipulated that work should be carried out from the office prior to the pandemic, with only occasional exceptions permitted for WFH. Similarly, employees at Charlie were permitted unofficially to WFH on Wednesdays when needed, while WFH was permitted one day per week in Alfa. Only Delta required employees to work solely from the office. Post-pandemic, no office presence was required by four of the companies (Alfa, Bravo, Echo, and Foxtrot), one specific office day was designated in Charlie, and Delta required office presence three days per week. This evolution reveals a pattern where the companies with more flexible policies around the work location of employees prior to the pandemic (for example, permitting occasional WFH days), maintained this flexibility after the pandemic. In contrast, in Delta, where the policy was more rigid, the post-pandemic policy also followed suite. Similarly, in Charlie, which had a specific WFH day allowed pre-pandemic, the company designated a specific office day post-pandemic.

In summary, we can state that the WFH scenario that was forced by the pandemic created an unprecedented opportunity for agile software teams to experiment with novel work arrangements. This experimentation was driven by the team members themselves and permitted by the companies through flexible work policies in some of our cases, while in others it was done at the policy level and imposed on the teams. Both of these approaches resulted in deviations from standardized arrangements and allowed the emergence of new and more fluid team arrangements.

8.2. Effects of the evolution

The second focus of our investigation was RQ2 (i.e., *What are the effects of the evolving work arrangements?*), which requires a more nuanced answer. In the remainder of this section, we will discuss several themes, to highlight multiple effects that emerged from our interviews.

We confirm that the role physical office spaces will have in shaping the future of the IT industry is unknown. Several companies are currently redesigning their offices to some capacity by updating and adjusting their workspace (Vasel, 2020), to mitigate the long-term risks and challenges associated with hybrid and remote work arrangements — concerns that have been raised by both practitioners and researchers. For example, the fear of a decrease in cultural and social aspects of the company (Clear, 2021; Fayard et al., 2021; Appel-Meulenbroek et al., 2022).

Although our findings did not reveal distinct challenges in these particular areas, they did show that there are a number of instances where the offices are largely empty due to the shifts in work arrangements, and concerns around this development were voiced by several participants (from Bravo, Echo, and Foxtrot). These findings are in line with the insights of Šmite et al. (2022b), who suggested hot-desking as one potential solution to the problem of empty office spaces. While this particular solution may provide benefits at the company level, our findings also revealed how organizational policies such as these can impact the team physical workspace. In two of the four companies in which free seating was implemented at the office (Delta and Echo), the practitioners found that this prevented the team from having an effective workspace, as they were not seated together. Indeed, prior research (Wang et al., 2022) has shown that assigned seating for agile teams was an important element in the workspace design, as this allowed team members to work together in the same physical space when they were present at the office. Ensuring that a workspace supports a team is therefore an effort that must be shared by both policy makers, as they can enable or disrupt it, as well as team members themselves, as they must consider the implications to practices and team dynamics.

Furthermore, we highlight the impact that workspaces have on creativity and the shifts in communication that have taken place. Prior literature, such as Bablo et al. (2023), has emphasized concerns about a potential decline in creativity in agile software development when team members no longer share a physical workspace. This concern was similarly voiced by participants from three of the companies (Bravo, Delta, and Foxtrot).

Regarding communication, our results show that the use of communication tools by the agile software teams has changed significantly during the course of the pandemic in four companies (Alfa, Bravo, Charlie, and Foxtrot), and the participants from the two remaining companies (Delta and Echo) reported that communication tools were used more heavily, which is in line with the findings from Ågren et al. (2022). Interestingly, the participant from Bravo had proposed keeping a Zoom room open all day for their team, but this idea was dismissed by the team members due to privacy concerns. This finding stands in contrast to the processes established by the practitioners in Ågren et al. (2022), who used open video and audio channels to simulate a physical workspace while working remote.

Another pattern that emerged was the need for improved coordination in the teams during the pandemic when all members were working remote. This is in line with prior research on the shift from office work to WFH by de Souza Santos and Ralph (2022), who found that group cohesion and effective communication strategies appeared to help preserve coordination within agile software teams working from home during the pandemic. Three participants (from Alfa, Bravo, and Echo) discussed similar communication practices to improve coordination, for example, having more meetings and ensuring everyone could attend them, as well as the preservation of group cohesion by agreeing on specific days to work together in the office.

Our analysis also revealed that the shifting work arrangements have distinct effects for individuals in leadership and management positions, particularly in regard to a loss of awareness and oversight, and consequently the need to be more proactive in their daily work to acquire the knowledge needed in their positions. In fact, an *office mode* with *synchronous schedule mode* supports middle managers and leaders in having awareness of the team, without the need to pull information from the team or from online communication channels. This emergent property is hindered in work arrangements in which team members are working from diverse locations, especially if the cooperation does not happen synchronously. More effort is spent monitoring communication channels to obtain such knowledge, as reported by our study participants. These insights are in line with the findings of Matos and França (2022) regarding the need for proactivity from leadership roles, and the experiences of the agile coaches discussed by Ågren et al. (2022).

8.3. Practical implications

We deliberately refrain from offering concrete recommendations or strategies for practitioners, as our sample size does not support broad generalization. While several suggestions could be inferred from the data – such as encouraging open team discussions around ways of working to mitigate the risks of misalignment – these would not be strongly substantiated by our findings. However, we do echo recommendations from related studies concerning underutilized or even empty office spaces (Moe et al., 2023) and the design of team physical workspaces (Wang et al., 2022; Bablo et al., 2023).

> **Recommendations:** Understand what drives office attendance. If employees are motivated to go to the office because their team is also present, encourage teams to agree internally on their office co-presence. This particular strategy can help to improve coordination and preserve group cohesion, while still maintaining flexibility at the policy level. To ensure that the team physical workspace supports the team, consider if fixed seating is necessary for specific teams or employees.

8.4. Future directions for research

By further extending the team typology and multidimensional model proposed by Šmite et al. (2022a) in this study, we were able to provide a more comprehensive conceptual framework for understanding the work arrangements of software teams. As discussed, some interesting patterns emerged when we utilized the team distribution classification, and similar studies could benefit from adopting this classification in future research. Additionally, few studies have explored the schedules of agile teams post-pandemic, so future research would benefit from exploring this topic, in particular the schedule alignment of teams.

Companies are actively exploring how office spaces can be reimagined to support collaboration, innovation, and employee well-being, prompting a shift toward repurposing physical environments to meet evolving workforce expectations. While these spaces were once thriving with activities, our findings indicate that many remain oftentimes empty. Moreover, when organizational policies adopt simple solutions, such as free seating or hot-desking, they often fail to support the workspace needs of agile teams, hindering their ability to work effectively.

As we move forward, understanding how organizational policies affect the way agile software teams function, what represents the workspace of a team, how teams utilize workspaces, and how they leverage technologies to cope or address the rapid changes, will be critical areas of focus for researchers, organizations, and industry practitioners alike. We see interesting future research opportunities focused on responding to the industry need to have operational results to support decision makers, as well as on investigating the long-term effects that these changes will have on software teams, their practices and dynamics, and on employees in leadership and management roles. A promising direction for further research is investigating the trade-off between team flexibility and cohesion. Our findings suggest that teams are designing specific practices – such as aligning their office co-presence – to improve coordination and preserve group cohesion. However, it remains unclear how practices like these might affect the overall flexibility of the teams.

Moreover, we have seen how the ability for managers and leaders to be aware of the progress and problems of individual members, as well as teams, has been hindered by the shifts in work arrangements. Further exploring these changes is a direction warranting further investigation; for instance, capturing the mechanisms devised to address these new limitations, and understanding the impact that lack of awareness and access to information has on the performance of teams are just some of the possible avenues.

9. Threats to validity

In the following, we discuss the threats to the validity of this study following the classification scheme by Yin (2018).

9.1. Construct validity

Our goal was to explore the evolution of different cases and collect exemplary instances. At the risk of not fully capturing the entirety of the work arrangements and policies, the interviews were driven by very open questions that were not leading the participants towards certain responses. Moreover, to ensure that we captured a diverse range of work arrangements we selected companies of different sizes and from different industry sectors. However, our study relied on interviews with individuals in leadership and support roles, without direct input from the team developers. This introduces the possibility that certain aspects of team-level experiences may not be fully represented. While management perspectives provide valuable insights into organizational decision-making and policy implementation, this limitation should be considered when interpreting the findings. Future research could incorporate other team member perspectives, such as developers, to complement our findings.

Participants were also contacted outside of the interviews to verify the findings and decrease the risk of misinterpretation, as well as to integrate missing details caused by the open nature of the questions, guaranteeing consistency in the information collected across cases. Drafts of the final versions of the results were shared with the participants (but from Charlie) for validation, seeking and obtaining their feedback and confirmation to improve accuracy. Nonetheless, two instances differ (i.e., the participants from Charlie and Echo). In particular, the participant from Charlie requested not to be contacted for follow-ups, making the information related to intermediate and post-pandemic periods based on the plans the company and the team had, rather than their execution; and, the participant from Echo provided insight on the work location for eight dispersed teams, which made capturing considerations related to the work schedule infeasible, due to their complete autonomy. Therefore, these gaps should be considered when interpreting conclusions, as they may affect the comprehensiveness of the dataset.

9.2. Internal validity

Our multiple-case study is exploratory and does not examine causal relationships (Yin, 2018), so we do not report on those aspects of *internal validity*, but limit this presentation to the considerations related to inferences. In this regard, all inferences presented in Section 8 are generated from data collected from multiple cases and corroborated by related literature, which has been presented in Section 3. However, we collected data only from effectively one source per company and companies were not systematically analyzed, which could affect the representativeness of certain perspectives within companies. Future work could address this limitation by recruiting more participants per company or by running a single case study, by which a detailed breakdown of the internal perspectives of each subject of study could be gained.

9.3. External validity

Given that the goal of our study was not to provide generalizable results, but to explore the evolution of a phenomenon, we are not concerned with threats to external validity. However, several limitations should be noted explicitly. First, the number of interview participants is relatively low compared to the 28 teams presented, which does limit the breadth of perspectives captured. Second, the study does not attempt to validate findings across cases, as the primary focus is on rich qualitative insights. Third, while we included cases from diverse company sizes and industry sectors, we do not claim sufficiency in terms of covering all possible policies and work arrangements. Fourth, our sample size remains small, and the majority of teams studied were located within Europe, which may limit the applicability of findings to other geographic contexts. Future research could expand the scope to include teams from different regions to enhance transferability. Finally, although our selection of cases prioritized diversity in work arrangements and policies, this does not imply generalizability beyond the sampled companies. Instead, our aim is to offer comprehensive and detailed descriptions that highlight the value of using the team typology and the spectrum of work arrangements. Our focus was on identifying interesting observations within the cases that could serve as potential candidates for transferability and generate grounded ideas for future research directions.

9.4. Reliability

We implemented several measures to enhance the reliability aspects of our study. The coding process used in our thematic analysis is described in detail in Section 4.3, and meetings were arranged on a regular basis, often including the entire research team, to discuss and clarify the understanding of the data, reducing the risk of single-researcher bias. The interview questions used and the codebook generated are also publicly shared to further contribute to the reliability aspects. While contingency plans were considered for participants that could not provide full data (see above), a systematic contingency approach for dropouts was not explicitly established.

10. Conclusion

In this study, we explore the evolution of agile software team work arrangements and the policies of six Danish companies, and report on their effects, from the perspective of team leaders, managers, scrum masters, and agile coaches. The results of our research highlight the emergence of a dynamic spectrum of work arrangements and organizational policies, reflecting a newfound flexibility that accommodates a diverse array of work locations and schedules. Building upon the work carried out by Šmite et al. (2022a), we further extend the team typology and multidimensional model by including a classification of the team distribution. This provided a more comprehensive conceptual framework for understanding the work arrangements of software teams, and revealed interesting patterns in the evolution.

Our investigation provides further corroboration of the concerns voiced by other researchers as well as management regarding the effects of evolving policies and work arrangements. Particularly, we take the opportunity to highlight the multifaceted, and currently poorly understood, impact of employee absence from company premises. While prior research on the offices of agile software teams post-pandemic has suggested that simple strategies like hot-desking could provide a potential solution to the problem of empty office spaces, our findings showed that policies such as these can in turn have an affect on the workspaces of the software teams. In addition, our findings show that the workspace of teams can impact their creativity; that agile teams are experiencing an increased need for coordination in hybrid and remote work arrangements: and, that the shifting forms of communication can bring about both benefits and challenges for the teams. Finally, we highlight the loss of oversight and subsequent awareness leaders and managers face in hybrid, partially aligned, variegated, and remote work arrangements.

We related these common themes to existing literature, confirming previously reported positions and policies and highlighting new ones; and, identify interesting future research opportunities focused both on responding to the industry need to have operational results to support decision makers, as well as on investigating the long-term effects that these changes will have on agile software teams.

CRediT authorship contribution statement

Emily Laue Christensen: Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Laura Caroline Cholvat:** Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Paolo Tell:** Writing – original draft, Visualization, Validation, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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Publication IV

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Hybrid Work in Agile Software Development: Recurring Meetings

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Hybrid Work in Agile Software Development: Recurring Meetings

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***Abstract*—The Covid-19 pandemic established hybrid work as the new norm in software development companies. In large-scale agile, meetings of different types are pivotal for collaboration, and decisions need to be taken on how they are organized and carried out in hybrid work. This study investigates how recurring meetings are organized and carried out in hybrid work in a large-scale agile environment. We performed a single case study by conducting 27 semi-structured interviews with members of 15 agile teams, product owners, managers, and specialists from two units of Ericsson, a multinational telecommunications company with a "2 days per week at the office" policy. A key insight from this study is that different types of meetings in agile software development should be primarily organized onsite or remotely based on the meeting intent, i.e., meetings requiring active discussion or brainstorming, such as retrospectives or technical discussions, benefit from onsite attendance, whereas large information sharing meetings work well remotely. In hybrid work, community meetings can contribute to knowledge sharing within organizations, help strengthen social ties, and prevent siloed collaboration. Additionally, the use of cameras is recommended for small discussion-oriented remote and hybrid meetings.**

***Index Terms*—hybrid work, large-scale agile software development, software team, meeting, community of practice, workspace.**

I. Introduction

The Covid-19 pandemic moved software professionals to their home offices, and their employers have found it difficult to get them back to the office due to the benefits of remote work, such as better work-life balance [1]. After the pandemic, hybrid software development, defined by Conboy et al. [2] as a setting where: *"some team members work mostly or completely from home, others mostly or completely from the traditional office, and others in some combination of the two—not quite distributed and not quite co-located but, rather, individuals working from anywhere and touching base with the office intermittently"*, soon became the norm.

As the topic of hybrid work in software engineering is new, there is not yet much systematically collected research data and results available. Existing studies focus mainly on remote work during the pandemic (e.g., [3]–[5]), but less so on post-pandemic hybrid work (e.g., [6]–[8]). A recent systematic mapping study on hybrid work in agile software development [9] found only twelve primary studies on the topic, which shows a severe lack of research. Moreover, Conboy et al. [2] urge the need for future research on hybrid work in software engineering. With this study we aim to start filling that gap.

The most commonly used software engineering methodology, agile software development [10], is based on face-to-face communication inside an agile team [11]. Thus, hybrid work in agile development necessitates rethinking how to organize communication and collaboration. For instance, Šmite et al. [12] argue that when software teams are fully aligned, i.e., they *"move between the office and the remote modes in an aligned fashion"*, this can help to avoid challenges associated with hybrid work and level the playing field experience.

Large-scale agile requires even more consideration because collaboration and communication between several agile teams, other stakeholders, and the rest of the organization needs to be planned. Typically, communication in large-scale agile is based both on ad hoc communication and on regular meetings, for example, daily stand-up meetings [13], [14]. In this study, we concentrate on one of the main forums for communication and collaboration in hybrid work in a large-scale agile environment, i.e., recurring meetings. These are scheduled meetings that usually occur at regular intervals, in contrast with ad hoc meetings, which are carried out sporadically. In the context of our case organization, a global telecommunications company — Ericsson, we studied our research question through 27 semi-structured interviews: *"How are recurring meetings organized and carried out in hybrid work in agile software development?"*

II. Related Work

Challenges in communication and collaboration among software professionals were common themes identified in several studies carried out during the Covid-19 pandemic (e.g., [3], [15], [16]), due to the sudden shift to remote work. For instance, Yang et al. [3] found that remote work caused more static and siloed collaboration among a network of Microsoft employees and suggested that hybrid work policies may have similar effects. Whereas, Rodeghero et al. [15] noticed that developers often kept their cameras off during remote meetings, which made collaboration even more difficult. Cao et al.

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[16] found that multitasking was a more prevalent behavior in recurring remote meetings, than in ad hoc meetings, with often negative effects, such as distraction.

However, only a few studies focus on meetings in hybrid work, in agile software development. The systematic mapping study by Khanna et al. [9] found only three studies that research the topic, and two additional studies that discuss meetings in connection with hybrid work. Next, we report the main findings of these studies.

Hybrid scrum meetings were investigated by both Buyukguzel and Mitchell [17], and Buyukguzel and Balaman [18]. The findings of these studies provide insights into how meeting participants establish and maintain progressivity, i.e., the continuity of work, by moving activities forward when disruptions occurred [17], and how they co-construct space, for example, by ensuring that participants at the office are within the screen radius, so they are visible and audible to remote participants [18]. Unscheduled meetings in hybrid work were explored by Sporsem et al. [19], to determine how developers maintain ad hoc communication. The findings showed that virtual rooms (e.g., on Discord or Zoom) help determine the need for unscheduled meetings, while Slack channels with fewer members offer a safe and free discussion environment, which also led to unscheduled meetings [19].

Although meetings are not the focus of [20] and [21], both of these studies of agile software teams revealed interesting insights on the topic which we briefly report here, and discuss further in connection with our findings in Section V. Firstly, in their study of workplace design, Wang et al. [21] found that teams need to agree on predefined onsite days for highly collaborative work, like product backlog refinement meetings. The authors also recommend coordinating and leveraging on-site time deliberately, while limiting the number and frequency of hybrid meetings, as these meetings can defeat the purpose of onsite work hours, which should be utilized for in-person collaboration and fostering social interaction.

Similarly, in their study of "work-from-anywhere" coordination strategies, Sporsem and Moe [20] found that teams avoid filling up their calendars with meetings during onsite office days, to enable collaborative work, so large meetings and retrospectives were exclusively held virtually on days where participants work from home.

In contrast to the aforementioned studies which focus primarily on remote meetings and on details within hybrid meetings specifically, we explore recurring meetings in hybrid work in a large-scale agile environment, and gather data on numerous types of meetings at both unit and team levels, as well as in management. Thus, our study aims to provide insights into how a whole set of meetings in hybrid work in a large-scale agile environment can be organized and carried out, thereby contributing to addressing the current scarcity of literature in this domain.

III. Research Design

To investigate recurring meetings in hybrid work in agile software development, we conducted an exploratory single case study following the guidelines of Yin [22] and Runeson and Höst [23]. A protocol for the case study was created and continuously updated throughout the research process [24].

A. The Case Company and Context

The case company is Ericsson, a multinational telecommunications company that employs about 99,000 people worldwide. On the company level, Ericsson transitioned to agile in late 2012. The site investigated in this study is the Finnish R&D site that concentrates on product and network security, cloud, 5G, and 6G research [25]. This site started its lean and agile transformation in 2009 [26]. The site employs around 700 professionals and applies a hybrid work policy where most employees are expected to work at the office two days per week. We investigated two units of the same site, which each implement the hybrid work policy in different models: Unit 1, where the 65 employees are expected to work at the office on Tuesdays and Thursdays, and Unit 2 where the two office days are flexible for the 70 employees. Unit 2 also closely collaborates with other sites in Europe and Asia, but our study only focuses on the two units in the Finnish site.

The hybrid work models were in an experimental phase at the beginning of our research. The R&D managers were interested in learning how the different hybrid work models and work arrangements of the teams impact collaboration and agile practices. Teams have the autonomy to decide which agile practices and events to apply in their work. In Unit 1, the six teams follow the Scrum framework quite closely. Whereas, the agile development process models followed by the nine teams in Unit 2 are more varied and combine aspects of Scrum and Kanban. None of the teams from the two units have a specific member acting as a Scrum master. However, most of the teams in Unit 2 implement a two-week rotation for their members to serve as team coaches. The agile teams varied in size: eight teams have between 4–6 members, six teams have between 7–9 members, and one team has 13 members.

The software project in Unit 1 has been in development for a couple of years. Whereas, in Unit 2 product development started over 20 years ago with the traditional waterfall way of working having system, design, and verification phases separately. Since early 2010 these were combined, and large-scale agile development was started [27]. The product itself has evolved throughout these years from native to virtual and cloudified versions. The interviews took place just before the launch of fixed team areas and workplaces for the first time after almost full remote work due to the pandemic. The two units were in the process of redesigning their office workspace to better accommodate these changes and the hybrid work models. The management was therefore interested in assessing the layout of the office premises to determine the value of fixed seating and other areas of the workspace, such as the meeting rooms. These interests aligned well with our research objectives, providing a compelling case for our study. In this paper, we narrow the scope to investigate recurring meetings.

To plan the research with the case company, a meeting was arranged between the researchers and several site managers

who presented the organization of the two units chosen for this study, the policy and models for hybrid work, the product domains, and the tentative future layout of the office workspace. The researchers also visited the office premises to observe the current work environment of the two units. Additionally, the meeting contributed to formulating our interview guide, which can be viewed in the supplementary materials[1].

Finally, the managers aided in sampling participants for interviews per the requirements of the researchers. To ensure that interviewees represented varying modes of work, roles, and teams in the company, we used purposive sampling, by asking the managers to suggest volunteers based on the following criteria: 1) one member from each agile team, in both units, 2) people outside of the teams who worked in varying roles, and 3) people with varying office presence, e.g., some who often worked from the office, others who rarely worked at the office, fully remote people, and those working according to the "2 days per week at the office" policy.

B. Data Collection

Qualitative data was collected via semi-structured interviews with 27 employees located in Finland. The employee's interview participation was voluntary and consent-based. Ten participants were from Unit 1 while the remaining 17 worked in Unit 2. Both male and female interviewees participated and their roles included members from all 15 agile teams, product owners (PO), managers, and specialists. An overview of the interviewee roles, years of experience in the company, and the participant ID's (P1–P27) can be seen in Table I.

The interviews were carried out via Microsoft (MS) Teams between November 2023 and February 2024 by one to three interviewers in English. Most interviews were conducted by two interviewers. At the start of the interviews, the participants were informed about the objectives of the study, how the results would be used, and the precautionary steps to maintain confidentiality. We also included this information in the consent form which all the participants signed. We then obtained their explicit verbal permission to record the interviews. Each interview lasted 60 minutes on average. All the interviews were video recorded via MS Teams with an automatic transcription-generating feature.

The first agile team member we interviewed was P3 [Team B]. After this the interview guide was refined by the research team to ensure more details were collected about how the meetings were carried out, such as the exact location when onsite, who facilitated, and camera usage. Given that the interviews were semi-structured, some of the meeting descriptions provided by the following interviewees were still slightly more detailed than others. Follow-up emails were therefore sent to 13 interviewees in April 2024 to inquire about a few particulars that were missing, for example, the duration of certain meetings. Ten interviewees provided responses to these emails which were added to their respective transcriptions. We did unfortunately not obtain a response from P3 [Team B], so the meeting descriptions provided by that interviewee lack some details, as can be seen in Figure 3.

[1]Supplementary materials: https://doi.org/10.6084/m9.figshare.25761945.v1

TABLE I
INTERVIEWEE DEMOGRAPHICS

Role	Experience	Participant ID
Agile team member (16)	4 months–34 years	P2–P4, P7–P9, P14, P15, P18, P20–P26
Product owner (3)	2–23 years	P6, P12, P13
Manager (5)	10–38 years	P1, P11, P16, P17, P27
Specialist (3)	4–26 years	P5, P10, P19

C. Data Analysis

We adopted a codebook thematic analysis approach to analyze and code our data [28]. The process began with manually editing the MS Teams generated interview transcripts to improve the accuracy and familiarize with the data, and ideas for coding were noted down. The first author generated an initial codebook containing 16 primary codes with their descriptions based on the notes taken, the study objectives, and the interview guide. These primary codes were limited to different *types of meetings*, the form of the meetings (*hybrid, remote, and onsite*), and *tools* used during meetings. A deductive approach was then used to identify data items that matched those 16 codes in three interview transcripts using NVivo R1. The codebook was then discussed in the research team and 10 additional codes were added based on the data from the first three interviews.

The first author then began a recursive process where the codes were identified in the data of all the interviews. As each code was added, the interviews which had been previously analyzed were reanalyzed to include each new code until the process was complete. An example of coding from one of the interviews is provided in the supplementary materials[1]. The codes were then sorted into themes which were further reviewed and refined, then defined and named jointly by the research team, resulting in the final codebook which contained 43 codes with distinctive descriptions[1]. Finally, the quotations from the interviews reported in this study were cleaned to remove filler words and repetitions, and anonymized to prevent the identification of participants. Every quotation is followed by the participant ID and either the agile team ID (A–O), for example, P9 [Team F], or the interviewee role, for example, P1 [Manager].

D. Feedback Sessions

Providing feedback and presenting analyses to participants is a critical step for maintaining trust and ensuring that the interpretation of the findings is reliable [23]. So, after the interviews, feedback sessions were carried out with each unit where the research team summarized the main findings from the interviews in a 25 minute presentation, followed by a 10 minute Q&A and discussion with the attendees. The feedback sessions were arranged at the earliest possibility after the data collection, as the management wished to use the findings and

relevant discussions for informed decision-making in the near future.

Both sessions were open to all the employees of the units, so all interviewees were invited, and the sessions were arranged virtually via MS Teams. Unit 1 had 73 people attending the session virtually, as it was held on a remote office day. Unit 2 had 42 people attending virtually, whereas about 10 people participated in-person from the unit's common sofa area. During the sessions, we recognized most of the interviewees, but unfortunately could not verify if all were present. The attendees found the results to be insightful and felt that they provided a good overview of the ways of working in the units, within the established hybrid work models. During the Q&A and discussion the attendees inquired how the findings from the units compare in general with the industry, and some specific work practices were discussed in more detail, for example, how to avoid interrupting other employees, and the use of cameras during meetings. The outcome of the sessions was only used to validate our findings, and no corrections to our results were suggested.

IV. Results

In this section, we present the results. We describe first the office presence of the interviewees and teams, and the office workspace and tools used during and in connection with meetings, and follow with descriptions of how the various recurring meetings are organized and carried out.

A. Office Presence

The office presence of the 27 interviewees and the 15 agile teams is visualised in Figure 1. Most interviewees are present at the office minimum two days per week in accordance with the hybrid work policy. Only two interviewees are rarely at the office, due to explicit remote work permissions. All members of the six agile teams in Unit 1 are usually at the office on Tuesdays and Thursdays following the unit implementation of the 2-day office policy. In Unit 2, five agile teams are in the office on the same two days each week. The exact days vary between these teams, as they are agreed on at the team level. One team works together from the office one day per month, and two others one day per week. The ninth team works primarily from the office on all working days.

The majority of the interviewees expressed satisfaction with the two different unit level implementations of the hybrid work policy. Only one interviewee from Unit 2 said that they did not see the point of having two office days, but this was stated in relation to the one-day-per-week team agreement about office co-presence: *"I don't really see the point of this second day myself, because if someone or half of the team is working remotely, then we anyway have the meetings via [MS Teams]. [...] If we should be here for two days, then maybe everybody should be here on the same days, but otherwise one day is enough."* –P24 [Team I].

B. Office Workspace and Tools

The office premises of the company contains meeting rooms of various sizes. The larger rooms are outfitted with conference

Fig. 1. Office presence of the interviewees and teams.

equipment, i.e., monitors, speakers, and microphones. Some of these rooms are MS Teams equipped [29], so they are specifically adapted to meet the needs of hybrid workers. MS Teams is the primary collaboration application for both units. It is used by all the employees for scheduling and hosting meetings. An overview of other tools used to conduct or support meetings is provided in Table II.

All of the larger meeting rooms need to be booked in advance, while the smaller meeting rooms can be used if they are available. The smaller meeting rooms can fit 2–4 people, and are primarily only equipped with monitors. Given that the larger meeting rooms need to be booked in advance, the meetings held in these rooms are limited to a fixed time slot: *"So [the meeting] usually never goes over the time because the meeting rooms are booked for a specific time. And we have so many teams that every team at some point would need that meeting room, so they kick us out [...] so not all the topics are always covered when we are face-to-face."* –P9 [Team F]. Remote meetings in contrast are not time-constrained in the same manner, which allows for more in-depth discussions when needed.

Both units have an open space on the company premises where the desks for the employees are spread out. At the time of the data collection, the company used a flexible seating system where employees would book the desks in Flowscape. Despite the free seating, the majority of the teams in both units would almost always sit together at the same desks when they were onsite. Only one team from Unit 1 said that the members

TABLE II
Tools

Tool	Meeting Type
MS Teams	All
Jira	Daily, Sprint Planning and Refinement
Physical whiteboard	Sprint retrospective and Sprint planning
Digital whiteboard	Sprint retrospective and Sprint planning
Confluence	Sprint retrospective, Sprint change and CoP's
Mentimeter poll	Sprint retrospective
Post-its	Sprint retrospective
PowerPoint	Operational meetings
OneNote	PO meetings

were spread out in the open office area when they worked onsite. Two teams have a specific closed-off area to work in, due to security reasons, which is separated from the rest of the teams. In these teams, the members do not need to move to a specific room during meetings, as there are only two teams in this area, and it is large enough that they do not disturb each other. The area they are sitting in is equipped with conference equipment, making hybrid meetings easy to carry out. The managers from both units also work from a separate closed room, so they carry out most of their meetings in that room when onsite.

C. Unit Meetings

The six teams in Unit 1 all follow the same iteration schedule of two-week sprints, with five sprints combined to produce one increment (see Figure 2). The whole unit meets in a single room at the office every 10 weeks for the *increment change* meeting which lasts 2–3 hours. The work achieved by each team is first presented, usually by the PO, and product management explains what should be achieved in the next increment. Following this, a common *retrospective* is carried out. Here anyone can suggest topics to improve, and each topic is discussed in smaller groups, then presented in plenum. Based on these discussions, action points are made for the whole unit. In addition, remote *sprint review* meetings for all the agile teams in Unit 1 are carried out bi-weekly on Monday evenings. The program manager delivers presentations or demos, and there is the possibility for discussion at the end of the meeting.

All nine agile teams in Unit 2 also follow a mutual iteration schedule with two-week sprints. They have a common remote bi-weekly *sprint change* event for all of the teams on Wednesdays (see Figure 2). The team coach for each team begins by sharing the work their team completed and key learnings from the previous sprint in plenum. Following this, the participants have smaller discussions on a team level in breakout rooms where they plan and discuss what they will be working on in the coming sprint: *"The sprint planning nowadays, the high level one on a project level, the one which is happening on Wednesdays. It's not a planning really. It's more like a celebration [...] it gives a high-level image to everybody of where we are and that would actually explain why there are certain priorities for a certain sprint."* –P13 [Product owner]. Before the meeting, the teams document their key accomplishments, learnings, and work for the next sprint in Confluence, so it is visible to everyone in the unit.

D. Agile Team Meetings

All the agile teams in the two units held several different recurring meetings for the team members, where the POs often also participated. An overview of the main types of agile team meetings in the two units is provided in Figure 3. The occurrence of these meetings varied slightly among teams. Sprint reviews were not carried out by any of the teams, as these were held during the previously discussed unit meetings.

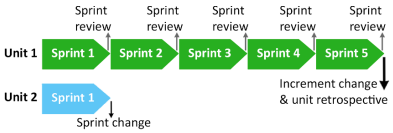

Fig. 2. Unit meetings.

1) Daily meetings: All interviewed agile teams in both units held daily meetings in the morning to discuss their progress and any impediments they encountered. The daily meetings lasted 5–45 minutes, depending on the number of team members and topics to discuss. Because these meetings were carried out daily, the form of the meeting (hybrid, onsite, or remote) always varied. If some team members were onsite, they usually joined the daily from a reserved meeting room. Only four of the teams joined the dailies from their work desks when onsite: *"[The team members] are usually joining from their desks. I'm also doing so when I have an office day. Everyone is using headsets to avoid background noise and echo."* –P23 [Team N]. When the daily meeting was fully remote, all the participants joined via MS Teams, and the application was also used during hybrid meetings: *"It's [the daily] always hybrid nowadays. Even if we are all in the office, we still go to the same meeting room and we connect to [MS Teams] if needed."* –P18 [Team H]. The dailies were described as being particularly useful meetings by five interviewees. One of these interviewees especially highlighted their importance during days when the teams were not working together at the office: *"These couple of days when you are not in the office, you really take the time in the morning to discuss with your team if you have any blockers or if you need any input. That's super important."* –P8 [Team E].

If the daily was remote or hybrid, most of the teams usually had their cameras on during the meeting: *"We just noticed that it's much nicer to actually see the person you're talking to [...] there is not a rule from company or anything, it's just in the team. We decided it's better like this."* –P15 [Team G]. Only three of the teams did not use cameras during dailies and the reasons provided by the interviewees for this included for example, poor internet connections for some members, or a lack of need because the whole team was viewing the Jira board via screen-sharing during the meeting: *"There's no real benefit [to using cameras]. I'm not staring at the camera anyway [...] I'm looking at my own screen."* –P23 [Team N]. The facilitation of the dailies varied. In seven teams, the PO usually led and facilitated the meeting. Whereas, a team member was responsible for this task in four teams: *"the [PO] is not the moderator of the daily anymore, so the team itself took ownership of that meeting"* –P4 [Team C]. Only one team did not have anyone in particular who facilitated the dailies.

2) Sprint planning and refinement: Four of the agile teams from Unit 1 carried out onsite sprint planning meetings on Tuesdays on a bi-weekly basis, following the unit level sprint

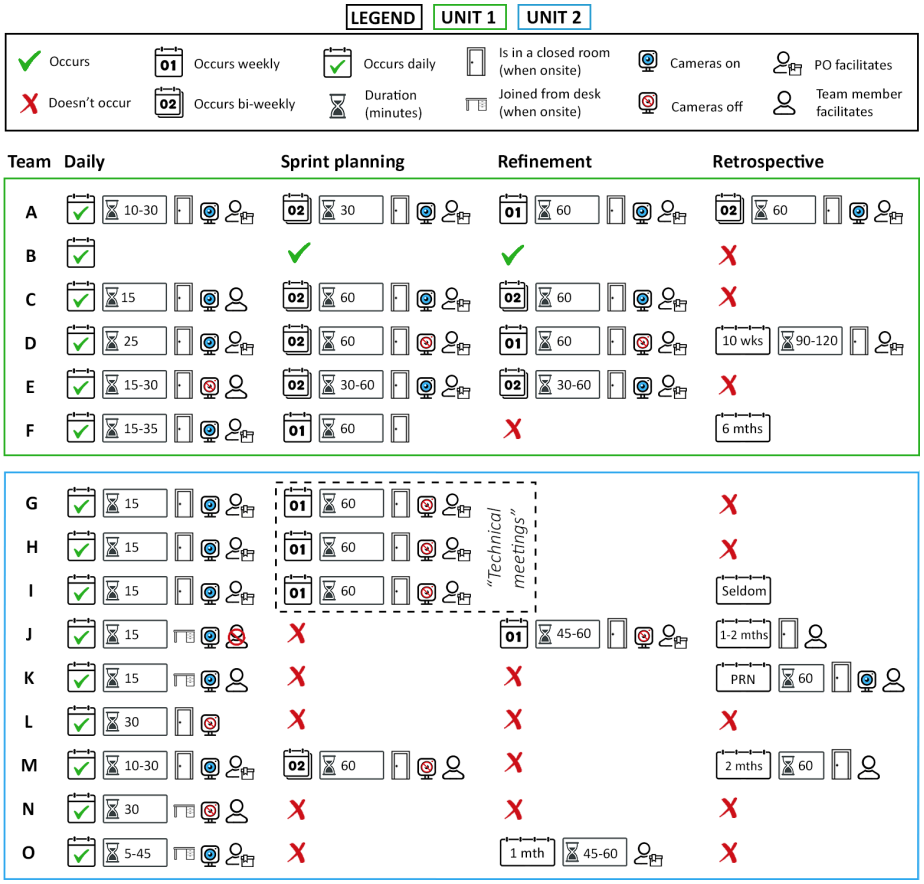

Fig. 3. Agile team meetings (PRN = as needed).

review meeting: *"When it comes to actually in the team planning the work that we are gonna do, the most important in-person meeting is user story planning, because there the team should sit together and really discuss the feature that they're working on."* –P4 [Team C]. Only one team held sprint planning meetings every week. In this team, the refinement of backlog items was done during the planning meetings, while four of the other teams in the unit held separate weekly or bi-weekly refinement meetings.

In contrast to Unit 1, most of the teams in Unit 2 carried out their planning for the sprints during the previously mentioned sprint change event. Only one team from Unit 2 carried out an additional bi-weekly remote sprint planning meeting specifically for their team: *"We sit down as a team and decide and prioritize what should be done and what should we take up next Sprint. And we also get the [PO] involved and as a team then decide the backlog and put the work items for the next sprint in the sprint list [...] it's mostly been on remote days."* –P21 [Team M]. However, three of the teams in Unit 2 had weekly one-hour time slots for *"technical meetings"*, during which they had discussions around various topics as needed, e.g., planning, features, or customer cases.

All the sprint planning meetings lasted 30–60 minutes, and the majority were facilitated by the PO. Only one team had sprint planning meetings that were facilitated by a team member. Jira was the primary tool used during the meetings, but both physical and digital whiteboards were also utilized by the teams.

Similar to Unit 1, one team from Unit 2 carried out weekly backlog refinement meetings, and one other team usually held these meetings monthly. In both units, the refinement meetings lasted 30–60 minutes and the PO always facilitated. When the sprint planning and refinement meetings were hybrid, cameras were used less often than during the dailies, as the teams were focused on the Jira board. In contrast with the dailies, none of the interviewees said that sprint planning or refinement meetings were carried out from their desks when team members were onsite. Only two interviewees did not mention the onsite location of the refinement meetings.

3) Retrospectives: Only one team from the two units organized retrospectives specifically for their team on a bi-weekly basis. Whereas, six teams from the two units held retrospectives for their members with varying occurrence, ranging from every 1–6 months, to *"very seldom"*, or as needed (PRN). The remaining eight teams did not organize their own retrospectives. A reason provided by three of the interviewees for the lack of retrospectives was that the team had been working together for a long time and quickly resolved issues when they arose: *"Most of us have been together very long and it's been kind of smooth working in this team. So we don't have that many issues to figure out."* –P15 [Team G].

A similar sentiment was expressed by an interviewee from one of the teams that had infrequent retrospectives: *"There's a lot of harmony between the developers and the members in the team, because they have the domain knowledge for the past 20 years and they're pretty much in sync about what the objective is, and what the goal is, and hence there is not much argument. That's why within teams there's probably not much need of retrospectives that frequently."* –P9 [Team F]. Only one person from the teams with no retrospectives expressed a potential benefit of these meetings: *"That's something that should be done regularly. If not every sprint, I would say at least every couple of sprints, because you don't really know what to improve on unless you really discuss it."* –P4 [Team C].

All the teams which carried out their own retrospectives did so either onsite from a meeting room, or offsite, and only rarely in hybrid form if, for example, a team member was unable to join in-person. Having the retrospectives as face-to-face meetings was discussed by four of the agile team members as preferable: *"We decided to do it on those days when everybody is at the office, or then everybody will come to the office when we book it beforehand."* –P26 [Team J]. The retrospectives lasted 1–2 hours, and if the meeting was hybrid, cameras were always used. Other tools used during the retrospectives included physical and digital whiteboards, post-its, Confluence, and Mentimeter polls.

4) Inter-team meetings: Some of the agile teams which were working on similar features or domains organized joint team meetings to share relevant information among them. For example, teams H and I joined all each other's daily meetings, while teams M and N had a combined daily meeting once per week: *"We have a common daily, so both the teams join. So that's on Thursday for both. That's sort of our common information sharing."* –P21 [Team M]. All the participants joined these inter-team dailies via MS Teams because the teams might not always be onsite at the same time. Finally, teams G and K met twice per week to discuss the development features they were working on and how to develop the test environment (not depicted in Figure 3).

E. Leadership Meetings

1) High level planning meeting: A high level planning meeting takes place in Unit 1 in the extended leadership team before the increment change meeting. Here the managers, POs, and specialists define the higher level plans for the coming increment. The meetings are typically carried out in the office because a lot of discussion takes place.

2) Operational meeting: The extended leadership team from both units have three regular operational meetings per week where ongoing topics are discussed. These meetings are held in the office on Tuesdays and Thursdays and include the management and the POs, as well as some specialists.

3) PO meetings: The POs in Unit 2 have status update reporting meetings every Monday, where they go through all the items they are working on and discuss ideas. They also have a weekly planning meeting on Fridays where they discuss coming features, problems, and delays. Managers from Unit 2 also sometimes join these meetings. All of these meetings are carried out in hybrid form, and most of the POs have cameras on when they are attending remotely.

4) One-on-one meetings: In both units, 30-minute one-on-one meetings are scheduled once a month between the line managers and the unit employees. The meetings can sometimes happen more often, for example, when new employees join the unit. In Unit 1, these meetings are usually carried out virtually via MS Teams to maintain the privacy of employees and because it is more efficient for the manager. Whereas, in Unit 2 one of the line managers normally organizes the meetings onsite when possible. Cameras are always used by both participants when the one-on-one meetings are virtual.

F. Community Meetings

In both units, meetings for the various communities of practice (CoP) are held regularly. There are two main types of community meetings: open community meetings where anyone from the unit can suggest a topic and everyone can participate, and closed meetings for role-specific community members (e.g., security leads, architects, and testers).

1) Open CoP meetings: In Unit 1, the open CoP meetings are organized twice per week. A one-hour meeting is held onsite on Thursdays (a unit office day) in a large meeting room, and the other session is a 30-minute remote meeting

which is held on Fridays (a unit remote day). These meetings were purposefully placed so attendees can schedule the topic based on the meeting intent. For example, topics that are better for face-to-face, or require discussions, can be scheduled for the office day. In Unit 2, the open CoP meetings are scheduled for specific time slots 2–3 times per week. The meetings are hybrid and most participants join online, but occasionally meeting rooms are booked for them. The meeting invitation shows if a room is booked and contains a link to the Confluence wiki page where employees can write a topic they would like to discuss: *"it's up to the team or to the person who can book a CoP session based on the needs and just inform it early enough. And the CoP sessions are in our calendars. [...] And this is something that I really like, to have this weekly based important information flow."* –P8 [Team E]. If no topics are suggested for a given time slot, the meeting does not take place.

There is some overlap between the CoP meetings in Unit 2 and other agile team meetings, in particular the dailies, because the Asian development sites' time zones must be taken into account when scheduling them. Due to this overlap, not all team members can always participate, as discussed by four interviewees: *"that's a bit challenging because many teams have their team dailies also at that time [...] people feel that they would need to join the team daily. That's the most important meeting of the team in a day. And then on the other hand, there might be really interesting topics [in the CoP], and that's creating a conflict in a sense that you need to choose [...] but there is not a silver bullet for this."* –P16 [Manager]. To ensure that the information is accessible, the meetings are often recorded so employees can view them later. Some of the agile teams have also decided that the team coach must attend these CoP meetings and share the information with the rest of the team.

2) Closed CoP meetings: The closed CoPs in both units are also referred to as "virtual teams" and each specific CoP has regular meetings where the community members (e.g., security leads, architects, and testers) have detailed discussions regarding the work in that area: *"I like to use the term virtual team, because they have their home team, but then they operate in this community where they share experiences. The intent is that each of the community members act as an ambassador towards the community, and then they bring back the best practices to their team."* –P1 [Manager].

These meetings are especially important for the specialists who are not connected directly to the agile teams, and to ensure that all of the teams are in sync: *"They're big topics, the ones that we are discussing there. And the [CoP] is used as a meeting to align views, because there are quite many teams."* –P10 [Specialist]. The amount and form of closed CoP meetings varies between communities. The architecture community in Unit 1 holds weekly two-hour meetings, alternating between onsite and remote. This alternation addressed a previous challenge voiced by the developers to help ensure that the architects were also available to talk to them when they were onsite: *"Other developers that are not part of that meeting were complaining that: Hey, we cannot talk with the [specialists] because they are trapped there in the meeting for two hours. So can you change it a bit? So we have it like this; one week face-to-face, and one week remote."* –P10 [Specialist].

The security community in Unit 2 also holds weekly meetings that are typically carried out in hybrid form. A meeting room is often booked at the office but MS Teams is used simultaneously, and community members often join the meeting from their desks. The testing community in Unit 2 had the most meetings, with at least three regular meetings per week. These are also joined by the employees from one of the international sites to ensure that both sites are working in sync. These meetings are carried out in the same form as for the security community and are referred to as "dailies".

Three of the interviewees mentioned in connection to the various closed CoP meetings that cameras are not used as often when people from different sites are joining the meeting, compared to the meetings among members of the Finnish site only. One of the main reasons given for this was poor bandwidth, particularly with the Asian sites. However, the lack of social connection between members may also be a contributing factor: *"when we have people who meet less often and are not so much the same community. I noticed many times that people just kind of leave the cameras off, and don't want to share so much of the private area."* –P27 [Manager].

G. Information Sharing Event

Unit 1 has regular information sharing events. These are carried out onsite as 20-minute informal coffee meetings every Tuesday and Thursday at 14:00. Besides informal information sharing, these events also provide an opportunity to introduce new employees in the unit, and social bonding for all: *"whenever we are onsite we have this coffee break. So all the teams go to this common room and have coffee together, chitchat. So it's like a relaxing time of 20 minutes where you can get to know each other more and relax a bit."* –P9 [Team F].

H. Meeting Preferences

In the previous sections, we reported our findings regarding various recurring meetings and how they are organized and carried out. We extend our findings in this section to include some of the preferences voiced by interviewees about meetings in hybrid work in general.

The *intent* of the meeting, i.e., the aim and purpose, affected the choice of how to organize the meeting: six interviewees mentioned that they prefer to have meetings that involve brainstorming onsite, as this allows for more spontaneous discussion and the use of physical whiteboards. Face-to-face meetings were also discussed by six interviewees as useful for other reasons, for example, because it is easier to ask questions: *"I think the meetings when we meet face-to-face in the meeting rooms are actually quite efficient, maybe more efficient than the [MS Teams] meetings I would say. It might be easier to raise your questions there than in the [MS Teams] meetings"* –P7 [Team D].

Two managers and one PO highlighted their preference to schedule virtual meetings involving international attendees on remote working days because the other attendees were also remote. Time zone differences among the sites also contributed to their decision. In addition, attendees can quickly switch between meetings when they are virtual. This can be more efficient when they have either a large number of meetings or back-to-back meetings during the work day, as discussed by two managers and one PO: *"I'm just swapping from one [meeting] to the other without any time loss. But if I had to attend to a room, then it takes me five minutes to get from one to the other and then I'm obviously late, so it's much easier to do it like this."* –P13 [Product owner].

One interviewee also voiced a preference for attending large information sharing meetings virtually, instead of joining the meeting from a large meeting room at the office, as this provided a better participation experience: *"We have this one meeting where there's a lot of people supposed to be there, so it's always cramped. You don't see anything from the back of the meeting room [...] [When using MS Teams] everyone has their headset on. Everyone has their own screen. Someone is throwing something so you can see it from your own screen, like really close and someone is talking right to your ear. So no information is missed at all. So that is definitely something that's worth mentioning that is good."* –P4 [Team C].

Finally, 18 out of 27 interviewees discussed their preference for using cameras during virtual meetings, describing it as useful or a good practice: *"In my teams, everyone is always using the camera [...] that is to me a very good practice, to have these cameras open and show that you are there."* –P11 [Manager]. Only one person said that they did not feel the need to use cameras as is reported in Section IV-D1 in relation to daily meetings. The remaining eight interviewees did not specifically discuss their preferences around cameras, although three of these interviewees did mention that they used them. One of the interviewees did voice concerns that people possibly keep their cameras off because they are multitasking during meetings. Despite this concern, only three interviewees mentioned that they multi-tasked during virtual meetings.

V. Discussion

In this section, we discuss our findings, relate them to existing literature, and highlight the key takeaways. We discuss the threats to validity towards the end.

A. Organizing Recurring Meetings

A key insight from this study of hybrid work is that different types of recurring meetings in agile software development should be primarily organized onsite or remotely based on the *meeting intent*, i.e., meetings requiring active discussion or brainstorming, such as retrospectives or technical discussions, benefit from onsite attendance, whereas information sharing meetings work well in remote format. For example, a virtual meeting for a larger audience with an agenda of presentations may even provide a better participation experience in comparison to a big onsite meeting room. In this case, a virtual meeting offers good visibility of the content with a clear voice and ensures equal experience for everyone. This insight is similar to the findings in [20] regarding large meetings, but differs in regard to retrospectives. While Sporsem and Moe [20] found that retrospectives were held online to ensure all team members could participate, the interviewees in our study preferred to hold retrospectives face-to-face.

As most agile meetings are based on active discussion, one might easily think that placing most meetings on office days would be the most efficient. However, our interviewees pointed out problems with that, because people need "free" time to meet and converse informally outside the meetings during office days, as discussed also by both Wang et al. [21] and Sporsem and Moe [20]. Especially, specialists and managers, who often have their calendars full of meetings, need to be available also for ad hoc discussions with the agile teams on those days when the team members work at the office.

We noticed that the layout of the office workspace affected meetings as well, in particular the agile team meetings. Given that employees from both units were expected to work from the office two days per week, the flexible seating system that was in place could be expected to provide benefits, and is discussed by Šmite et al. [1] as a potential solution for companies that are experiencing only partially used offices, due to hybrid work. However, our findings revealed that the majority of the agile teams preferred fixed seating arrangements and had in practice turned the flexible seating system into fixed seating by always booking the same seats for their team. This allowed them to organize and attend team meetings from their desks, as well as have ad-hoc discussions easily.

Takeaway: Organizing numerous back-to-back meetings on office days can hinder informal ad hoc conversations, so we recommend that meetings requiring active discussions or brainstorming are organized onsite, while information sharing meetings can be remote. More research around office workspace design and flexible seating systems is needed, as these can have a direct impact on collaboration and meetings in hybrid work.

B. Community Meetings in Hybrid Work

The community of practice (CoP) meetings discussed by the interviewees in this study provide an ideal platform to share knowledge not only inside a team, but also between the teams and across the whole organization. Even though attendance is not always possible for everyone, due to the overlap in meetings, recording the CoP meetings to create a digital footprint and provide non-attendees with access to the information, or having one team member attend the meeting and bring the information back to the rest of their team, ensures that experiences and best practices are continuously shared within the entire community. Thus, these meetings and the strategies used when organizing and carrying them out, provide one solution to the challenge of static and siloed collaboration that was emphasized during remote work in [3]. Similarly, meetings like the information sharing coffee events

held by Unit 1 provide an opportunity for networking and the strengthening of social ties across the whole unit.

Takeaway: Community meetings and the strategies used when organizing and carrying them out, like video recording, can ensure knowledge is shared within organizations, help strengthen social ties, and prevent siloed collaboration in hybrid work.

C. Using Cameras in Meetings

The use of cameras during remote and hybrid meetings is a topic that has been discussed and studied especially during the Covid-19 pandemic [15], [30]. The majority of our interviewees found that having cameras on during hybrid and remote meetings was useful and a good practice. At the team level, the use of cameras was discussed as particularly beneficial for meetings like the dailies and retrospectives, where participants discuss with one another. In contrast, during more technical meetings, like backlog refinement meetings, everyone looks at the shared screen (e.g., Jira board), therefore having cameras on was not felt that useful. Additionally, in cross-site meetings that involve people who meet less often, they tend to more easily leave their cameras off. More research in this area is needed, as using cameras may be beneficial to help strengthen networks between people working in different sites. Finally, despite the concern voiced by one interviewee regarding possible multitasking when cameras were kept off, this behavior was not prevalent in our results, which stands in contrast to findings from previous research [16].

Takeaway: Cameras can be beneficial in remote and hybrid meetings that require active discussion between participants, but may not be as useful during more technical meetings. The use of cameras therefore requires further attention to learn their advantages or disadvantages.

D. Threats to Validity

We report threats to validity per the guidelines by Runeson and Höst [23]. Our case study is exploratory and does not concern causal relationships, therefore, *internal validity* aspects do not apply [22].

1) Construct Validity: Our study is not prone to the threats of construct validity because our interview guide contained a substantial amount of questions related to collaboration in hybrid work. Additionally, certain questions were explicit in querying about the meetings in hybrid work. All the interviewers and the study participants are knowledgeable about agile development process models and practices, and the different types of meetings in agile, which alleviates the possibility of a different understanding of the construct between the participants and the interviewers. The feedback sessions also strengthened the construct validity, although some limitations do exist, given that we could not confirm all interviewees were present at the sessions. A draft of this paper was also shared with the company managers for validation, and they confirmed that the results were accurate.

2) External Validity: The external validity of case studies is limited to the studied context [23]. Our findings related to meetings are yet generalizable to similar contexts, i.e., companies that apply hybrid work policies and models in large-scale agile software development, as well as companies that seek to transform their workspaces to facilitate a collaborative environment for hybrid work. Moreover, our sample was not limited to the members of agile teams, but included multiple roles, with varied years of experience in agile software development.

3) Reliability: We implemented multiple measures to enhance the reliability of our study. Our integrated coding approach promotes the possibility of developing a similar codebook by other researchers. The iterative coding approach and joint meetings among all the authors to discuss the codebook further improved the reliability. We publicly share the interview guide and codebook with descriptions of all levels of coding to further contribute to the reliability aspects. Thus, decreasing the subjectivity in data analysis.

VI. Conclusion and Future Directions

This study offers qualitative insights into how recurring meetings are organized and carried out in hybrid work, in a large-scale agile environment. We performed a single case study in the Finnish R&D site of Ericsson with a "2 days per week at the office" policy. 27 participants including agile team members from 15 different teams, managers, product owners and specialists participated in the semi-structured interview data collection. We observed that sprint planning and retrospectives are preferably organized and carried out onsite by the agile teams because they require active discussions, while daily meetings are typically hybrid. In addition, organizing a hybrid participation possibility for all meetings is often necessary to include everyone.

For practitioners: It is better to arrange meetings requiring active discussions or brainstorming onsite, whereas, information sharing meetings can be remote. Office days should not be booked with numerous back-to-back meetings because this can limit informal, yet important, ad hoc discussions. Community meetings can contribute to knowledge sharing within organizations, and help strengthen social ties and prevent siloed collaboration in hybrid work. Additionally, the use of cameras is recommended for small discussion-oriented remote and hybrid meetings.

For future research: Studying the dynamics of ad hoc meetings in hybrid work, and understudied meetings like technical meetings, can offer more useful insights. In companies with varying hybrid work models, future research could investigate how having both predefined and flexible office days impacts inter-team collaboration in meetings. The use of cameras in remote and hybrid meetings also requires further attention to learn their advantages or disadvantages.

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Publication V

Broomandi, F., Christensen, E. L., and Paasivaara, M.
One Size Does Not Fit All: How To Organize Hybrid Work in Agile Software Development?

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One Size Does Not Fit All: How To Organize Hybrid Work In Agile Software Development?

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***Abstract*—*Background*: Hybrid work, which combines remote and office work, has become common after the Covid-19 pandemic. While many software companies embrace hybrid work to retain talent, this shift challenges agile software development, which values in-person collaboration. However, adaptation is central to agility, so agile companies are adjusting to their evolving needs, including the rise of hybrid work. *Aims*: This study explores how different types of companies organize hybrid work in agile software development to fit their unique organizational contexts. *Method*: We conducted a comparative multiple case study based on 39 semi-structured interviews with developers, product owners, specialists, and managers from two companies. We studied two agile software development units at the Finnish R&D site of Ericsson, a mature global telecommunications company, and one unit at Kempower, a young Finnish industrial company. *Results*: The study found that hybrid work guidelines, infrastructures, events, and communities in agile software development varied significantly across the units, yet employees in each unit generally reported satisfaction with their arrangements. The approaches were shaped by multiple factors, e.g., how team members were dispersed geographically, whether collaboration was mainly internal or included external partners, and the company's maturity. *Conclusions*: Our findings suggest that there is no one-size-fits-all approach for agile software development in a hybrid work environment. Instead, the successful adoption of hybrid work requires context awareness.**

***Index Terms*—agile software development, hybrid work, comparative multiple case study.**

I. Introduction

Hybrid work, a setting where *"some team members work mostly or completely from home, others mostly or completely from the traditional office, and others in some combination of the two"* [1], is not a new concept, but has gained popularity after Covid-19. Post-pandemic, many employees favor hybrid models for their flexibility, influencing job retention [2], [3]. To retain talent, many software companies seek to balance office work and remote work [4], [5], and according to several studies (e.g., [6]–[8]), hybrid work will become the long-term norm for software development.

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In agile software development (ASD), face-to-face communication is emphasized as the most effective means of conveying information [9]. Agile practices like sprint planning and retrospectives rely on frequent interaction and collaboration, traditionally supported by teams working together in the office, but hybrid work challenges this, requiring a balance between agility and flexibility [10], [11]. However, adaptation is central to agility, and agile companies must adapt to evolving needs, including the rise of hybrid work [12]. Companies can explore better ways to support ASD, for example, by developing new tools, using existing tools to enhance events and practices, or by introducing new practices that improve efficiency in hybrid work environments [11]. To support this experimentation, more research is needed to identify effective approaches for adapting ASD to hybrid work environments.

In this multiple case study, we compare the guidelines, infrastructures, events, and communities of two agile companies — the Finnish R&D site of Ericsson, a mature global telecommunications company, and Kempower, a young Finnish industrial company — to understand how they adapt to hybrid work in the current post-pandemic era, based on their unique settings and contexts. By comparing a mature global corporation and a young industrial firm, we aim to highlight how the organizational context influences hybrid work, and provide actionable recommendations for companies navigating or considering hybrid work adoption in ASD. We collected data through semi-structured interviews with 39 participants from the two companies to investigate our research question: *"How do different companies organize their guidelines, infrastructures, events, and communities for hybrid work within agile software development environments, considering their unique settings and contexts?"*.

The structure of this paper is as follows. In Section II, we review related work, while Section III outlines our research design. We present our findings in Section IV, discuss their implications in Section V, and address the study limitations in Section VI. Finally, Section VII provides concluding remarks and suggestions for future research.

II. Related Work

As highlighted in many studies, including [1], [5], [13]–[15], reliable research is essential for guiding companies as

they adapt their policies and practices to better accommodate hybrid work. Studies that explore the adaptation of ASD to hybrid work environments often provide high-level approaches and recommendations. We identified several key themes in prior literature on the topic, i.e., tools, meetings, policy flexibility, in-person events, location-based work, and office redesign, which are further described in Table I.

While the need for adaptation in hybrid work environments is emphasized in several of the themes described in Table I, as well as in other studies which discuss hybrid work in software development, such as [1], [4], [11], [16], few studies fully account for the importance of considering the unique organizational context and specific settings when selecting approaches for hybrid work in ASD. In addition, while the research interest in the intersectional area of hybrid work and ASD has grown after the Covid-19 pandemic, the number of studies remains limited, as discussed by Khanna et al. [17]. We aimed to address this gap, by conducting a comparative multiple case study in two companies, to examine how each company implements hybrid work approaches differently, based on their distinct characteristics and organizational contexts.

TABLE I
THEMES IDENTIFIED IN RELATED STUDIES

Theme	Description and references
Tools	Collaborative tools can facilitate effective communication, enhance collaboration, support task management, promote transparency, and keep teams aligned in hybrid work [10], [14], [20]–[24].
Meetings	How meetings can be organized for better efficiency in hybrid work [10], [14], [22], [23], [25], [26].
Policy flexibility	By allowing employees to choose remote or office work, and their own work hours, work-life balance can be improved and diverse needs accommodated [14], [15], [20]–[22].
In-person events	Holding regular in-person events like workshops and team-building activities can strengthen relationships and enhance collaboration in hybrid work [14], [15], [20]–[22].
Location-based work	Assigning remote days for focused tasks, and office days for collaboration can enhance productivity [10], [13], [15], [20], [21].
Office redesign	The importance of creating more functional spaces that support focus and collaboration in hybrid work environments, and equipping the office workspace appropriately [14], [15], [24].

III. RESEARCH DESIGN

To examine how companies organize their guidelines, infrastructures, events, and communities for hybrid work in ASD, we conducted a comparative multiple case study, following the guidelines of Yin [18] and Runeson and Höst [19].

A. Description of Cases

We investigated two cases, the Finnish R&D site of Ericsson, a mature global telecommunications company, and Kempower, a young Finnish industrial company, both of which implement agile methodologies and have adopted hybrid work. As outlined by Yin [18], careful case selection is crucial in comparative multiple case studies, as the cases should produce contrasting outcomes for anticipatable reasons. Two different companies with distinct organizational contexts were therefore selected, allowing for a comparative analysis. An overview of the case description is provided in Table II.

The Finnish R&D site of Ericsson (hereafter referred to as Ericsson), employs about 700 professionals [27], adopted agile in 2009, and uses a Large-Scale Scrum (LeSS) inspired agile framework. Kempower, a Finnish industrial company also has around 700 employees [28], and adopted a Disciplined Agile Delivery (DAD) inspired framework in 2019. Globally, Ericsson requires employees to work from the office two days per week. The implementation of this requirement will be further discussed in the results (Section IV). Ericsson is a well-established and long-standing site in the company, whereas Kempower is a younger, fast-growing company, that began expanding rapidly during the pandemic. While the cases differ in maturity, growth pace, and use of agile frameworks, both employ hybrid work models.

In our investigation, we examined two units in Ericsson, referred to as Unit E1 and Unit E2, with 65 and 70 employees respectively, and one unit in Kempower with 43 employees, referred to as Unit K. Unit E1 consists of six agile teams, which mostly range from six to nine members, with one larger team of 13. Unit E2 has nine agile teams with four to seven members each. Unit K consists of five agile teams with six to eight members. All teams in Unit E1 use an adapted Scrum approach, while the teams in Unit E2 blend Scrum and Kanban, and both units run synchronized sprints. Similarly, three teams in Unit K use adapted Scrum, and two teams are transitioning from Kanban to Scrum. All teams within the three units follow a product owner (PO) led leadership model, with some closely collaborating teams sharing a PO. In Ericsson, a strategic decision was made to operate without dedicated Scrum masters. However, Unit E2 adopts a rotational coaching model, with developers taking turns as coaches every two weeks. In Unit K, two of the developers also work as part-time agile coaches for the teams.

Regarding communication and collaboration tools, both cases use Jira for task management, Confluence for documentation, and Microsoft (MS) Teams for synchronous and asynchronous communication. Kempower additionally uses Slack to facilitate informal, spontaneous interactions, while MS Teams is the primary tool for formal meetings and scheduling, due to its calendar integration.

Ericsson operates from a single main office in Finland, where both units are based, and most of its employees reside in the surrounding area. In Unit E1, half of the employees have more than 10 years of experience in the company, and the other half has less than five years. The software project in Unit E1 has been about two years under development. In Unit E2, most employees have been with the company for over 10 years, and the product development started over 20 years ago, evolving throughout the timeframe. In addition, the teams in Unit E2 collaborate closely with other sites of the global company, in

TABLE II
DESCRIPTION OF CASES

	Ericsson	**Kempower**
Founded	1918	2017
No. of employees	Around 700	Around 700
Industry	Product and network security, cloud, 5G and 6G research	Electric vehicle charging solutions
Agile adoption	2009	2019
Large-scale agile	Inspiration from LeSS	Inspiration from DAD
Special characteristic	Well established and long-standing	Young and fast-growing
Work model	Hybrid	Hybrid
No. of units studied	2 units: Unit E1 & Unit E2	1 unit: Unit K
No. of employees in unit	Unit E1: 65 Unit E2: 70	Unit K: 43
No. of teams in unit	Unit E1: 6 Unit E2: 9	Unit K: 5
Agile framework used by teams	Unit E1: Scrum Unit E2: Scrumban	Unit K: Scrum and Kanban
Agile roles	Unit E1: PO Unit E2: PO and rotating team coach role	Unit K: PO and part-time coaching by developers
Tools	Jira, Confluence, MS Teams	Jira, Confluence, MS Teams, Slack
Company distribution	One office in Finland, collaborates globally	Four offices in Finland (different cities)
Tenure at company	Mostly over 10 years	Mostly under 3 years

other countries. In contrast to Ericsson, Kempower operates multiple offices across four cities in Finland, with no team based entirely in one office. During the pandemic, Kempower expanded nationwide to attract top software talent, so most employees in Unit K have less than three years of tenure.

B. Data Collection

This study adopts a qualitative approach, using semi-structured interviews to gather data. A total of 39 employees participated voluntarily, all of whom provided written informed consent. This included 10 employees from Unit E1, 17 from Unit E2, and 12 from Unit K. The participants included developers, POs, specialists, and managers. The selection of participants was carried out in collaboration with case representatives to ensure diversity in roles, experience, and team affiliation. An overview of the roles and experience of the participants is provided in Table III, which highlights that Ericsson employees, particularly in Unit E2, generally had longer tenures than those in Unit K. Owing to confidentiality agreements with the cases, we are not permitted to disclose more detailed demographic information and are unable to publish the interview transcripts.

The interviews were conducted between November 2023 and February 2024, using our interview guide[1], which was developed with the help of case representatives. The semi-structured questions covered participants' backgrounds, roles, and experiences with ASD, as well as their perspectives on hybrid work. The key topics included daily routines, collaboration tools, knowledge-sharing, social interactions, and workspace infrastructure. All interviews were conducted remotely via MS Teams, except for one in-person interview at Kempower. Each session, which lasted about 60 minutes, involved one to three interviewers and was conducted in English. Participants were first briefed on the study's objectives, data usage, and confidentiality measures as per the consent form. With verbal permission, the interviews were then recorded and transcribed via MS Teams. Additionally, we visited both companies' premises to observe their office workspaces, providing valuable context for the interviews.

TABLE III
PARTICIPANT DEMOGRAPHICS

Unit	**Role**	**No.**	**Tenure at company**
Unit E1 (10)	Developer	6	4 months–16 years
	Product owner	1	2 years
	Specialist	2	4–21 years
	Manager	1	10 years
Unit E2 (17)	Developer	10	7–34 years
	Product owner	2	14–23 years
	Specialist	1	26 years
	Manager	4	13–38 years
Unit K (12)	Developer	6	10 months–3 years
	Product owner	2	4 months
	Specialist	2	1 year
	Manager	2	5 months–2 years

The interview data from Ericsson was utilized in [29], which focuses on organizing recurring meetings in hybrid work in a large-scale agile environment. Any similarities between the two studies are due to the shared data source.

C. Data Analysis

To analyze the data, codebook thematic analysis was employed, following the guidelines of Braun and Clarke [30]. The MS Teams generated transcriptions were first manually edited for accuracy. The analysis process began with a read-through of the interview transcripts by the first author to become familiar with the content. An initial codebook was then created in an Excel sheet, based on the study objective and the interview guide, which consisted of 45 primary codes. The codes were aligned with the research question and focused on the guidelines, infrastructures, events, and communities used in the three units. The following analysis was conducted iteratively by the first two authors using NVivo 14, with new codes being created and themes identified. The codebook was collaboratively reviewed and refined throughout the analysis by the first two authors, to ensure the reliability of the process. An example of the data coding is provided in the

[1]Supplementary materials: https://doi.org/10.6084/m9.figshare.28874573.v1

supplementary materials[1]. By the end of the analysis process, the final codebook contained 76 codes and 12 themes, which is also made available online[1]. The participant quotes used in this paper were cleaned, anonymized, and labeled with an ID (e.g., E1–P01, where E1 is the unit and P01 is the participant). We do not include participant roles when referencing quotes, as some roles are held by only one individual, so disclosing them would compromise confidentiality.

D. Validating Procedure

Shortly after the interviews, the main takeaways from the collected data were presented to each unit through separate feedback sessions. Each session consisted of a 25-minute presentation followed by a 10-minute Q&A segment. The feedback sessions were open to all members of the investigated units and conducted in a hybrid format via MS Teams. Participants were specifically invited and generally attended. Unit E1 had a total of 73 attendees; Unit E2 had 52 attendees; and Unit K had 27 attendees. According to Runeson and Höst [19] and Yin [18], having case subjects review preliminary results is an effective strategy to enhance the validity of a case study. Hence, these sessions helped confirm the validity of our findings, as no revisions or objections were raised. Additionally, the final version of this paper was reviewed and confirmed by case representatives.

IV. Results

In this section, we present our results. The findings reflect the guidelines, office infrastructure, events, and communities at the time of the interviews, which have since evolved, as we briefly discuss in the concluding remarks (Section VII).

A. Unit Guidelines and Team Office Co-presence

In both cases, the guidelines around work schedules define core hours in which employees must be available, i.e., between 9:00–15:00 in Ericsson, and between 9:00–14:00 in Kempower. The unit guidelines regarding work location are more varied, as is the office co-presence of the teams. We have defined several different types of guidelines for the location of employees in hybrid work, based on the findings in this study, and on a previous study [29]. Our definitions of the guidelines are shown in Fig. 1, while the exact implementation of each guideline is described in the following section.

Fixed guideline: In Unit E1, most employees are required to work from the office every Tuesday and Thursday, an office presence guideline we define as 'fixed' (see Fig. 1). One participant from Unit E1 explained the reasoning behind this decision: *"In previous units, there were endless debates about office attendance [...] To avoid that [in our unit], we decided early on to set fixed office days."* (E1–P01). The six teams in the unit are collocated, i.e., all members operate from the same physical location [31], and are present in the office every Tuesday and Thursday in accordance with the guidelines (see Fig. 1).

Semi-fixed guideline: Unit E2 offers more flexibility by adopting what we define as a 'semi-fixed' guideline (see Fig. 1) for office presence. Employees are allowed to choose their preferred office days, as long as they meet the requirement of two office days per week. Six of the teams in the unit are collocated, while three teams are partially dispersed, i.e., one or a few members are situated in different locations, compared to the majority who are based in the same physical location [32], as they each have one member who works entirely from home. While four teams are present at the office, the same two days every week, similar to Unit E1, the other five teams have more varied office co-presence, ranging from almost always, to once monthly, as can be seen in Fig. 1.

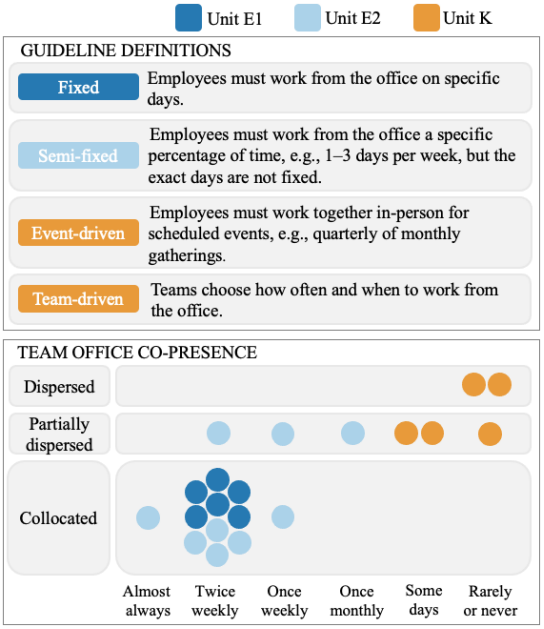

Fig. 1. Unit guidelines for the work location of employees and team office co-presence. Each circle represents one team.

Event-driven and team-driven guidelines: Kempower adopts two guidelines, which we define as 'event-driven' and 'team-driven' (see Fig. 1). Employees are expected to be present in-person for unit-level events, but otherwise, the teams should decide when and where to meet. As stated by one participant, *"We are required to be present for unit events, and then the teams define their own needs"* (K–P01). The reason behind the adopted guidelines is largely due to necessity, as employees are located in multiple locations and all of the teams are either partially dispersed, or dispersed (i.e., most or all members are distributed across various locations [33]).

Interestingly, in contrast to the teams in Ericsson, none of the teams in Kempower have made agreements about fixed office days. Two of the partially dispersed teams do however have members who are co-present at the same office some days every week, while the other members work from home (see

Fig. 1). In the remaining three teams collaboration is almost entirely virtual, as the members never, or very rarely, work from the same office at the same time. Some teams have also experimented with planned, but ad hoc, in-person team days. For example, one team organized an in-person agile workshop to improve cohesion and awareness of individual work styles, while another team held a Scrum hackathon to facilitate the transition from Kanban to Scrum.

Finding 1. The guidelines for office presence in the three units have four variations; fixed, semi-fixed, event-driven, and team-driven, which are shaped by the organizational context. The team office co-presence varies in accordance with the guidelines and the members' location, ranging from almost always to rarely or never.

B. Employee Satisfaction With Guidelines

Regarding the schedule guidelines, no participants expressed dissatisfaction with the core hours in any of the units. The actual schedules of participants were quite varied outside of the core hours, with some starting their work days for example at 7:00, and ending earlier, while others started at 9:00 and finished later, but this was not an issue for the participants: *"Some people work earlier and finish at 15:00, so there might be some questions for them, but it's not a problem cause they can be reached the next day."* (E1–07).

Overall, the participants are quite satisfied with the two different office presence guidelines in Ericsson, with 20 mentions of satisfaction in total (nine from Unit E1 and 11 from Unit E2). Ten participants specifically highlighted the balance the guidelines offer, as one explained, *"It's good to be home some days and nice to meet people on others. Two days at the office and three at home is a good balance."* (E1–P06). Although the guidelines are fixed, and semi-fixed, seven Ericsson participants noted that the guidelines provide a high degree of flexibility: *"It gives a lot of flexibility. When we need to come to the office, we can, but there are also many times when I need to focus and work on my own."* (E2–P11). Other key benefits of the guidelines discussed by the Ericsson participants included the opportunities for in-person collaboration (n=6), and socialization with colleagues (n=3), while still being able to carry out more focused work at home (n=3), which they felt optimized their productivity (n=4).

Regarding the employee satisfaction with the guidelines in Kempower, more than 50% of the participants (n=7) focused on the flexibility and freedom they entail, highlighting this as a positive aspect: *"It's working very well because we have the freedom to choose."* (K–P09). However, four participants did express a desire for more regular in-person team days, as one of them explained, *"It makes sense to have a [...] team day where you could work on the specific things you have on your plate and utilize that time with the team together."* (K–P02). Similarly, one person highlighted that they would like to work with their team in-person at the office more often: *"I would like to have more regular work days, just sitting close by teammates, but that requires more planning."* (K–P10).

Finding 2. Despite the variation in the guidelines, employees in the three units are satisfied with their units' respective guidelines, largely due to the balance of office and remote days (Units E1 and E2), and the flexibility to choose when and where to work (Units E2 and K). However, some employees in Unit K desire agreements at the team level to have more in-person team days and work days.

C. Office Infrastructure

Both Ericsson and Kempower utilize an open office layout design, have a variety of meeting spaces, and use a hot desking system where employees do not have assigned desks, and have to book a workstation when coming to the office. We discuss these aspects of the office infrastructure in the following section. Both cases also support ergonomic home offices by providing employees with fully equipped workstations, including adjustable desks, chairs, monitors, and peripherals. While the home offices are not the focus of this research, the participants from both cases were satisfied with the provided equipment and did not express any additional needs.

Meeting spaces: Larger meeting rooms, equipped with MS Teams Rooms technology [34] to support both in-person and virtual collaboration, are provided by both cases and require booking. In Ericsson, there are also smaller meeting rooms for two to four people, mainly equipped with monitors, and commonly used for virtual meetings, personal calls, or tasks that require privacy and concentration: *"We have different kinds of small meeting rooms where you can just go, without needing to book [...] if the meeting room is free you can just use it [...] This, I think works very well"* (E1–P08). Similarly, Kempower provides frameries (meeting pods) for up to four people, used for private discussions or focused work in a quieter setting. Kempower also offers phone booths for one or two people, suitable for private calls or to concentrate on heavy tasks. All small meeting rooms and the frameries are available on a "first come, first served" basis.

In Ericsson, a total of eight participants, four from Unit E1 and four from Unit E2, shared difficulties related to meeting spaces. In Unit E1, two participants noted that larger meeting rooms are sometimes fully booked, preventing them from continuing discussions beyond the scheduled time. Similarly, three participants from Unit E2 mentioned that the larger, well-equipped meeting rooms are insufficient and frequently occupied. One participant emphasized the importance of having enough meeting spaces, especially due to frequent collaboration with other sites. Even when employees are in the office, meetings are often hybrid, requiring a room where those attending in-person can gather and connect with remote colleagues at other locations: *"We need enough meeting rooms because the culture is remote, even if we go to the office, because we have teams in other sites [...] You shouldn't need to put heavy effort into finding a meeting room."* (E2–P17).

Furthermore, one participant expressed frustration with the technical setup, explaining *"The screens do not always work,*

it's easier to use individual screens instead of wasting time trying to make it work [...] It can also be tricky when people have different operating systems." (E1–P06), while two participants from Unit E2 mentioned that all meeting rooms should be modernized, equipped with better cameras and improved audio quality, to support remote collaboration with other sites. Regarding the smaller meeting rooms, one participant described them as uncomfortable and cramped, stating, *"They feel like phone booths. I need space around me when I work."* (E1–P02). In addition, two participants from Unit E1 suggested adding some pictures, flowers, or plastic plants to make them cozier and colorful.

When comparing the two units in Ericsson, the participants in Unit E1 placed more emphasis on smaller meeting rooms, often used for virtual meetings, personal calls, and focused work, as more employees are present in the office simultaneously. In contrast, the participants in Unit E2 showed a greater need for larger meeting rooms in both quality and quantity to support hybrid meetings with a large number of attendees at the office and in other sites.

Similar to Ericsson, four participants from Unit K expressed concerns about the insufficient availability of meeting rooms, including larger rooms and frameries. One participant explained, *"Meeting spaces have been the bottleneck, as there's a limited number of meeting rooms."* (K–P01). One other participant explained further that the limited availability of appropriate meeting spaces affects how people plan their office days, stating, *"If there are only two or three people in the office, they might join meetings from their desks [...] Some people might even choose to stay home because there aren't enough spaces, either ad hoc meeting rooms or the larger ones that require booking."* (K–P04). Four participants did state they sometimes join meetings from their desks, if they are the only meeting attendee who is working from the office.

While the meeting rooms were described as well equipped in Kempower, as a participant shared, *"Meeting rooms! That's one thing indeed. The meeting rooms in the offices are well equipped."* (K–P12), the shortage is especially challenging, as team members are spread across different offices and thus rely on hybrid and virtual meetings, and available spaces to hold them.

Finding 3. Hybrid work requires numerous well-equipped meeting rooms, both when a large number of employees are at the office, as they need spaces for discussion, and when less employees are at the office, because spaces are needed for hybrid meetings. Comfortable, small meeting spaces are especially needed for the teams in Unit E1, as they have higher office co-presence, and use the small rooms more frequently for individual work.

Workstations: In Ericsson, six participants expressed frustration with the hot desking system, highlighting the inconvenience at both the individual and team level. At the individual level, the inconvenience of not being able to leave personal belongings added extra effort when coming to the office, causing frustration: *"the laptop, keyboard, and mouse, that we have to carry with us when we come to the office [...] Hopefully that's going to change."* (E2–P14). One participant even suggested scheduling office days consecutively to reduce the frustration caused by the hot desking system, explaining that back-to-back office days make it easier to use the same desk and leave belongings in place overnight.

At the team level, the difficulty of finding seats near team members was discussed by the participants: *"We try to sit together, but booking flex seating through the application is required. If you're late, you won't find a seat next to your team."* (E1–P09). In line with this sentiment, one person suggested having a closed team area for discussions and focused work: *"Teams should have their own team room where they can have some debates or brainstorming. On the other hand, they can concentrate and not to be disturbed."* (E2–P06).

In contrast, in Kempower, no frustration with the hot desking system was expressed by the participants. Since employees are spread across multiple locations and a few team members are present at the same office at the same time, there is less need for everyone present to sit together. Hot desking was in fact seen as beneficial for accommodating visiting colleagues from other cities: *"[Hot desking] is useful because we have a lot of members from different cities [...] If team members who aren't based in this office come, it's easy to adjust and sit next to them."* (K–P10).

In addition, the hot desking policy in Kempower states that permanent seats will be assigned to employees who work from the office four or five days a week, to accommodate their consistent presence, which was seen as positive. As one participant explained, *"I do tend to sit in the same spot. We're creatures of habit. It can be hard to fully embrace the concept of hot desking, when you're used to a particular chair or lighting."* (K–P10).

Finding 4. For the teams who are often co-present at the office, hot desking caused personal and team inconvenience, leading to frustration. For teams who are co-present at the office less often, hot desking is practical and even beneficial, as is assigning fixed workstations for individual employees who are frequently at the office.

D. Events

All of the units hold some regular events, tailored to their specific context, which we describe individually in the following section.

Sprint review: At the end of each two-week sprint, Unit E1 holds a sprint review. During the review, product managers present the achievements of the previous sprint, showcase completed work, and outline goals for the upcoming sprint. The event is held virtually on Mondays, one of the designated remote workdays, because according to the experience of participants, the virtual format is more effective for larger presentations: *"We conduct it virtually because presentations are more effective in virtual settings than in-person."* (E1–P01).

Unit increment change and retrospective: At the end of each increment, which spans across five sprints, Unit E1 hosts a full day in-person event, which is also referred to as a unit day. The event begins with an increment change session, where product managers recap the achievements of the past increment and provide updates from product management, offering guidance on future focal points. This is followed by an increment retrospective, where the teams collectively reflect on the previous increment, and engage in focus group discussions to come up with actions for improving their work process. The participants were satisfied with the event and the format, with three mentioning that they especially valued the retrospective component: *"They're important because they have retrospectives on those days. We go through what was learned in the increment."* (E1–P05).

Sprint change: In Unit E2, each two-week sprint culminates with a virtual sprint change event, held on Wednesdays. The event starts with product knowledge sharing in plenum, continues with summaries from team coaches, and ends with team breakout sessions for sprint planning. A shared Confluence template is used to guide discussions on past accomplishments, upcoming plans, and key learnings, with team coaches responsible for documentation and presentation during the event. The sprint change is held virtually in this unit, to accommodate cross-site collaboration: *"It's virtual because in sprint change [events], multiple sites participate."* (E2–P08). Overall, participants were satisfied with the event and the format. Two participants especially appreciated the sprint change event because of the product-related knowledge sharing that took place: *"It's good because we are still delivering to the same product and release. We hear news about the release, and also what other teams are working on."* (E2–P14).

Information sharing: Every other week, on Fridays, the project management team in Unit E2 hosts a 30-minute hybrid information sharing session. The event follows a fixed two-part agenda. The first part consists of an appreciation segment, product and business updates, and customer insights, while the second part focuses on dynamic discussions, such as social events and tech talks. Although management sets the overall agenda, individual speakers also present specific topics, ensuring effective knowledge dissemination. The event is held in a hybrid format to ensure that all employees have the opportunity to attend, regardless of their location, which works especially well considering that it is held at the end of the work week: *"If you're not at the office, you're just going to join from home. It's Friday."* (E2–P08).

Unit day: Similar to Unit E1, Unit K organizes a full day in-person event every six weeks, known as unit day, for all employees. The event includes workshops, strategic discussions, hands-on demos, new colleague introductions, social activities, and a segment for appreciation. The unit day event serves multiple purposes: to share information about the broader product vision, build familiarity between teams through cross-team workshops, and encourage informal discussions that support social interaction and relationship-building between employees.

The in-person format of the event provides a valuable opportunity for employees to build relationships and socialize with colleagues they might not otherwise meet with on a day-to-day basis, which in turn makes it easier to cooperate virtually: *"Physical presence at these unit days ensures that employees meet in person, engage in off-topic and personal conversations, and build trust. This shared culture and trust make it much easier to cooperate virtually."* (K–P01). Eight participants from Unit K expressed positive views about unit days, highlighting their value for fostering in-person interaction among their colleagues: *"People from all over Finland come to one place [...] we can talk in person, not only on the product-related things but also discussing what's in their minds."* (K–P11).

Finding 5. A virtual event format is most effective for events with presentations, like the sprint review, and is necessary to accommodate cross-site collaboration in the sprint change event. In-person events, like the unit days, are most beneficial for discussions and socializing. Organizing the information sharing event in a hybrid format ensures equal attendance opportunities for all employees.

E. Communities

Three units across our cases organize different types of communities of practice (CoPs), which we discuss in the following section.

Closed CoPs: In Unit E1, closed CoPs are organized for employees with specific roles, e.g., architects, testers, designers, or security leads, who engage in these communities, in addition to their core team duties. Each closed CoP holds meetings based on need, weekly or biweekly, either virtual or in-person. However, a hybrid format is always maintained to accommodate those who are unable to attend in-person. The topics of discussion vary, but the agenda is always distributed in advance to ensure participants are well-prepared. One participant emphasized the experience sharing that takes place, stating *"[Closed CoPs'] members have their home team, but they also operate in this community to share experiences. The intent is that each member acts as an ambassador, bringing best practices from the community back to their team."* (E1–P01). In Unit E2, closed CoPs are organized in a similar way to those in Unit E1, but are primarily conducted in either fully virtual or hybrid formats to accommodate participants from other sites.

Open CoPs: The open CoP in Unit E1 is an inclusive community for all employees to share experiences and exchange knowledge. As one participant explained, *"If a team comes up with a new solution or way of working, they can present it to the entire company [...] Mostly related to coding practices and streamlining other processes."* (E1–P09). Two slots are reserved for open CoP meetings, one in-person on Thursdays (office day) and one virtual on Fridays (remote day). The format is determined by the agenda, with discussion-based topics scheduled for in-person sessions on Thursdays

and presentation-focused topics held virtually on Fridays. As one participant explained, *"If you have a lot of discussions or brainstorming, it might be better to have that on an office day."* (E1–P02). Anyone can propose a topic and lead a session, and they are only held if topics are proposed.

In Unit E2, there are different types of open CoPs in which all employees can participate, each with different structures. The types include coaching, unit-specific, and product-related. Each open CoP has a reserved time slot, held weekly, bi-weekly, or even twice a week. These community gatherings are typically held virtually to support participation from global sites, and are often scheduled in the afternoon after the daily team meetings. Some are also held in the morning to accommodate different time zones, and therefore overlap with the daily, which makes attendance for some teams challenging, as discussed by four participants: *"It's on top of our daily [...] We are allowed to go there even though we have daily, but I have chosen to take the daily instead."* (E2–P05).

In both units, the open CoP sessions are recorded and presentations are shared afterward to ensure accessibility for those who cannot attend. Moreover, in Unit E2 the team coaches distribute the agenda for the open CoPs daily in advance, allowing individuals to decide whether to participate based on their interests. Three participants mentioned that there are so many open CoPs, so they only attend some of them: *"If it's an interesting topic or something useful, then I try to participate."* (E2–P15). If a topic is particularly relevant, coaches may suggest that the entire team, or at least one member, attend.

Aside from the challenges mentioned regarding the overlap of daily meetings and open CoPs in Unit E2, participants in both Ericsson units expressed generally positive views on the closed and open CoPs. The value of open CoPs for sharing knowledge and best practices across the organization was highlighted by the participants, as one stated, *"It's important for fostering collaboration, not just within small teams but across the entire company"* (E1–P08).

Guilds: Similar to the closed CoPs in Ericsson, guilds in Unit K are cross-team, role-based groups (e.g., architects, product managers, designers, testers, and coaches), that complement members' core responsibilities: *"We have guilds, which are cross-team collaboration groups, like the architects or agile coaches guild, that help keep teams aligned and connected across the unit."* (K–P04). Guild sessions are held weekly or biweekly, with flexible durations based on the agenda, and may be canceled if there are no discussion topics. All sessions are hybrid to support both in-person and virtual participation. The guild masters manage scheduling, documentation, and follow-ups via a dedicated Confluence page. Each guild also uses Slack channels for continuous, asynchronous communication and updates.

Similar to Ericsson, the participants in Unit K also expressed positive views about the guilds, and no one mentioned any downsides. The guilds function well as a dynamic platform for accomplishing tasks and enhancing practices within the various fields: *"We critique each other's work, offer help, and share ideas."* (K–P12). The guilds were also highlighted as particularly valuable for cross-team agile collaboration, as one participant states, *"I like this model [...] we have many people working on the same, large product. To stay agile, teams need to remain small, but we also need a way to communicate across teams."* (K–P10).

Finding 6. In hybrid work, communities provide valuable opportunities for sharing knowledge and experiences within specific groups, and fostering collaborations across a unit. The format for community sessions is largely based on the topic, with in-person sessions preferred for discussion and brainstorming, while hybrid and virtual sessions can accommodate all employees, including those located at other sites.

V. Discussion

In this section, we discuss our findings and their implications in connection with prior literature on hybrid work in ASD.

A. Implementing Guidelines for Hybrid Work

The guidelines for office presence in the three units have four variations, which we have defined as: fixed, semi-fixed, event-driven, and team-driven. While the guidelines vary, each unit implements what Conboy et al. [1] defines as a 'calendar-based approach', which is characterized by predetermined schedules in which employees are entitled to work remotely for a certain number of hours or days per week, or for specific weeks per month or year. Our findings also show that team office co-presence varies significantly, but is determined largely in accordance with both the guidelines and the location of team members.

Within Ericsson, Unit E1 implements a fixed two-day office presence guideline, which is similar to the guidelines discussed by Wang et al. [21] and Bablo et al. [22], who advocate setting specific office days for in-person collaboration. Unit E2 implements a semi-fixed guideline, allowing teams to choose their two office days, which works well for the unit, possibly because the product is more mature and employees have longer tenure. Kempower follows both an event-driven guideline, which is similar to one example described by Jackson et al. [35], of a company that supports remote work, yet recognizes the importance of in-person events, so they organize these events three times a year for their employees. In addition, Kempower also follows a team-driven guideline, and while some have held ad hoc in-person team gatherings, some employees expressed a desire for more in-person team and work days.

Although the office presence guidelines differ across cases and units, employees in the three units are satisfied with their units' respective guidelines. The balance of remote and office days was highlighted by the Ericsson participants, while the flexibility to choose when and where to work was highlighted by the participants in Unit E2 in Ericsson, and in Kempower. These findings show how different guidelines

can succeed when they align with collaboration needs and employee expectations.

B. Designing Office Infrastructure

The redesign of office spaces to better support hybrid work has been discussed in prior studies, e.g. by Neumann et al. [14], who advocate for investments in equipment, such as 360-degree microphones, high-quality cameras, and digital whiteboards. Similarly, Wang et al. [21] emphasize that well-equipped conferencing tools, hybrid collaboration software, and access to phone booths and varied meeting rooms are crucial not only for effective hybrid meetings but also for maintaining focus in open office settings. Our findings also support the need to redesign office infrastructure and invest in both the quality and quantity of meeting rooms. However, such efforts should extend beyond technology and infrastructure, incorporating deliberate planning to accommodate diverse modes of collaboration.

Hot desking has been recommended as one solution for underutilized office spaces in hybrid work environments [2]. Companies like Kempower, especially as they grow and evolve, can benefit from hot desking systems to optimize office space. With a workforce based on multiple locations, fewer team members are in the same office at the same time, allowing for more flexible use of available workstations. However, for companies where employees are often at the office at the same time, like Ericsson, assigning fixed desks or team areas may be more effective. This is supported by Moe et al. [4], who found that employees preferred fixed team zones because they gave each team a dedicated home zone. Similarly, Wang et al. [21] reported that teams with fixed office days aligned to sprint rhythms were assigned dedicated desks to support their presence.

C. Organizing Events

Bablo et al. [22] highlight that events focused on project vision enhance team commitment by fostering shared understanding. Similarly, all units in our study organized events to communicate product-related information, though their approaches varied. Our findings provide nuance to how such events can be structured to support shared understanding in hybrid environments. Both units in Ericsson require at least two office days per week and the teams follow synchronized sprints, but the events differ in structure. Unit E1 uses a fixed schedule with virtual sprint reviews and in-person unit days to reinforce vision and cohesion, while Unit E2 adopts a more flexible approach, adapting events such as sprint changes and information sharing to hybrid and virtual formats, supporting global collaboration and flexible participation. Kempower, meanwhile, has no fixed office days, as employees are based in multiple offices, but relies on periodic in-person unit events to share product updates and maintain team connection.

D. Building Communities

Building community when many employees are working from home can be a challenge for companies, as described by for instance Šmite et al. and Moe et al. [2], [4]. Similarly, the units in our study addressed these challenges by adapting their communities of practice to align with employees' office presence and collaboration patterns. In Kempower, all guild meetings are structured in a hybrid format, aligning with the unit's flexible office presence guideline. In contrast, Unit E1 in Ericsson follows a different approach. Since employees are in the office two days a week, open CoP meetings in Unit E1 are held either virtually or in-person, depending on the content, with in-person sessions preferred for discussion and brainstorming. Two slots are reserved for these meetings: one virtual on a remote day and one in-person on an office day. Topics are assigned to each slot based on their suitability for virtual or in-person format. However, in Unit E2, where collaboration with other sites is common, open CoPs meetings are conducted in a virtual format to include participants from different locations.

E. One Size Does Not Fit All

As discussed in the previous subsections, the guidelines, infrastructure, events, and communities for hybrid work in ASD environments varied across different cases and units, each tailored to their specific context and setting. These findings are supported by prior literature (e.g., [1], [11], [14]), which emphasize the need for adaptation in hybrid work environments. Thus, when organizing hybrid work, the one-size-fits-all approach is not optimized, and companies should tailor hybrid work arrangements to align with their unique operational needs and workforce dynamics.

Key takeaway: One size does not fit all in hybrid work. Hybrid work guidelines, infrastructures, events, and communities in ASD should be customized based on companies' unique settings.

Our recommendations for tailoring hybrid work in ASD environments, based on our findings, are presented below.

- Encourage teams experiment with organizing in-person days and gatherings, if they are not co-present at the office often.
- Involve employees in the design of office infrastructure, as beyond the meeting rooms and equipment needed for in-person, virtual, and hybrid meetings, consideration should be given to the diverse needs of employees in hybrid work. For example, fixed seating and team spaces for teams who are often co-present at the office may prove beneficial.
- Select the format of the events based on the intent of the event. Use virtual formats for presentation-driven and cross-site collaborative events, like sprint reviews and sprint change events; choose in-person formats for interactive and social events such as unit days; and adopt a hybrid format for events like information sharing, to ensure equal participation for all employees.
- Establish inclusive, cross-functional communities that are open to all employees, as this can significantly enhance

the sharing of product-related and unit-level information, especially in hybrid work environments where such details might otherwise be overlooked.

VI. Threats to Validity

In this section, we assess the validity threats of our case study according to Yin [18] and Runeson and Höst [19].

Construct Validity: In our study, construct validity was ensured through a comprehensive interview guide addressing guidelines, infrastructures, events, communities, and employee perceptions in the different hybrid work environments. The questions focused on individual work, team collaboration, tools used, and employees' views on workspaces. All participants were experienced in ASD and hybrid work, minimizing the risk of misinterpretation. Feedback sessions were held to confirm the findings' validity, with no objections or revisions raised. Additionally, the final version of this paper was reviewed and confirmed by case representatives.

External Validity: To enhance external validity, we conducted a comparative multiple case study using theoretical replication logic to capture both convergent and divergent patterns. Both cases use ASD in hybrid work environments but differ in organizational settings. While the findings are analytically generalizable to similar contexts, particularly ASD companies in the Nordic region adopting or transitioning to hybrid work, they may not apply to companies with different cultural, geographic, or organizational settings. The detailed case descriptions and inclusion of diverse roles support both transferability and broader insight for generalizability.

Reliability: For reliability, a standardized interview guide was used to ensure consistency across interviews. Multiple researchers were involved in data collection and the codebook was collaboratively refined throughout the process. To enhance transparency and support replication, both the interview guide and final codebook are made available online.

VII. Conclusions and Future Work

This study offers qualitative insights into how companies customize their guidelines, infrastructures, events, and communities in hybrid work within ASD environments, and how they vary based on their unique organizational contexts. A comparative multiple case study was conducted, with 39 semi-structured interviews involving developers, product owners, specialists, and managers. There were 27 participants from two units in Ericsson, and 12 participants from one unit in Kempower. The guidelines, infrastructure, events, and communities for hybrid work in ASD environments varied across different cases and units, each tailored to their specific context and setting. Successful adoption of hybrid work in ASD environments requires careful adaptation, not uniform solutions.

Our findings offer actionable guidance and recommendations for companies navigating hybrid work in ASD. When designing office presence policies in hybrid work, companies should consider workforce dispersion and collaboration needs. Hot desking helps optimize space for companies with dispersed and partially dispersed teams, whereas fixed desks and fixed team areas may better serve teams with aligned office co-presence. Offering fixed desks for frequent office-goers can also reduce friction. In office redesigns, team presence patterns matter. Prioritize meeting rooms for full-team attendance, and provide smaller, quiet spaces for individuals or small groups to collaborate, or join virtual meetings. For events aimed at knowledge sharing and community building, companies should align the format, i.e., virtual, in-person, or hybrid, with office presence of employees and the event goals, to maintain flexibility and accommodate remote participants.

These findings reflect early experiences with hybrid work after Covid-19 and are based on the context at the time of data collection. Since then, both case companies have continued to refine their guidelines and infrastructure. For example, the two units at Ericsson have shifted to three weekly office days and fixed team workstations, while Kempower has increased their focus on team days and gatherings. These developments highlight that hybrid work is still maturing and being actively shaped based on ongoing experiences.

For future research, longitudinal studies on hybrid work in ASD could reveal how guidelines, infrastructures, events, and communities evolve over time, especially as companies continue to experiment and refine their approaches. We also encourage future research to examine this topic in other regions, outside of the Nordic countries, for broader insight.

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