Hybrid Work in Agile Software Development

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Abstract

The disruption from pre-pandemic office work norm to forced work from home, has been followed by new norms in work arrangements. This has triggered changes in the understanding of the characteristics of a software team work arrangement and what workspace allows the teams to thrive. In response to new demands, many companies are altering their work policies and experimenting with new work arrangements that balance expectations from employees and management, regarding where and when the work should be done. The goal of this work is to investigate these new ways of working, including work arrangements of agile software teams, and hybrid teams in particular, and the work environments of companies. The project will also explore software process improvement ideas that decision makers should consider when dealing with various team work arrangements.

Keywords

Hybrid work, agile software development, software teams, work arrangements, workspaces

1. Problem Definition

Creating any significant software requires the effort and cooperation of several people – a team. Two types of teams have been used traditionally to reason about software development: the traditional or collocated team, and the virtual team [1]. The work arrangements of teams in this context are understood as the approved work pattern in which normal hours are worked, and the categorization of teams as either traditional or collocated, and virtual, has allowed for instance: to design practices for teams sharing the same physical space like pair programming [2]; to reason about the effects of geographical, temporal, linguistic, and cultural distance in the context of globally distributed virtual teams (e.g., [3, 4]); and, to reflect on the idiosyncrasies that make a seemingly simple artefact like a task board so complex to replicate digitally [5]. However, new types of teams and work arrangements are surfacing that do not conform to either the collocated, or the virtual category.

The word *"hybrid"* has become one popular umbrella label attributed to various work-related terms. These days, one can often read about hybrid workplaces or hybrid offices [6], hybrid working [7] as well as hybrid teams [8]. Hybrid teams are related to distributed teams, but instead of office locations, their members could work from home (WFH), a café, or anywhere else. These are Halford's [9] teams consisting of *"multiply-located"* members working in the office and from home and more recent hybrid teams described by Santos and Ralph [8], as teams in which, on any given day, some team members may be working in a collocated office while others are working remotely.

The shift in types of teams and work arrangements was rapidly accelerated by the covid-19 pandemic, which forced most employees to transition, from one day to the next, to WFH arrangements. During the immediate pandemic period [10], companies learned that many preconceptions about remote work were misplaced, and software developers adapted to the emerging situation quite swiftly [11, 12] with their daily work lives not particularly disrupted [13]. Such better-than-expected forced WFH experiences, coupled with the investments enabling remote work during the pandemic, led many knowledge workers to rethink their return to the offices [14].

The interest in working remotely from home or in an alternative working space like a café has now become mainstream and has given ground to situations where employees work indiscriminately from either home or the office [15], shifting team dynamics from those described by virtual team models to those fitting the collocated ones. 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 [14, 16]. In response to the new demands, many companies are altering their work policies and experimenting with new work arrangements that balance expectations from employees and management, regarding where and when the work should be done [14].

Software processes and practices, theories, and models currently used in the software industry and in software engineering research are insufficient to accommodate for the new trends as they do not account for these shifting work arrangements, which results in the inability to achieve the full productive potential of agile software teams and to make sense of field material. It is therefore crucial that we gain a better understanding of where employees want to be working and how modifications of the work environment affect ways of working, in order to determine the best way to adjust the workspaces to fit the needs of agile software development teams.

2. Knowledge Gap

The shift from WFH to work from anywhere (WFX), while predicted [17, 16], has not yet been explored in depth, as recent studies on the topic were conducted prior to, or during the pandemic in a forced WFH situation [18, 19, 20, 11, 16]. Here two major foci of interest can be identified. On the one hand, studies focusing on metrics of developers; under this category, developer productivity [21], productivity and well-being [22, 11, 23], perceived productivity [12], as well as task satisfaction and performance [24], can be found. On the other hand, there are studies investigating specific technical practices [25] and the consequences to the processes (e.g., [26]).

As sharply identified by Boland et al. [27], *"leading organizations will boldly question long held assumptions about how work should be done and the role of the office."* However, although briefly discussed in several of the above-mentioned studies, the workspace has not been the focus, likely given the importance during the pandemic to understand the pressing consequences of the forced WFH condition, and only a limited number of studies – yet rapidly growing – can be found that research specifically the workspace and the work arrangements of agile software teams (e.g., [28]).

The goal of this work is therefore: to investigate these new ways of working, i.e., the work arrangements and environments of hybrid agile software teams. The project will also explore

software process improvement ideas that decision makers should consider when dealing with various team work arrangements. The scope of this project is visualized in Figure 1. In addition, the project will also explore how these work arrangements, environments, and improvement ideas impact the teams in relation to collaboration and agile practices.
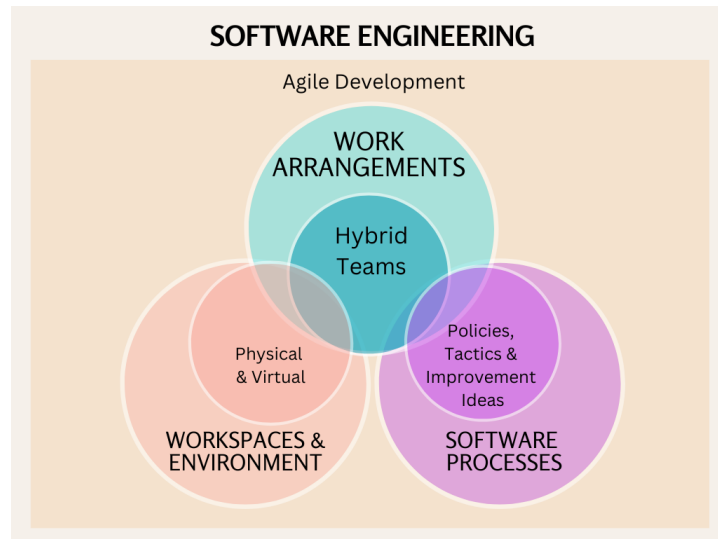

Figure 1: Project scope

3. Research Method

The following research questions have been designed to guide the work in this project:

RQ1: How can the spectrum of emerging hybrid work arrangements of software teams be characterized to achieve better clarity?

RQ2: What are the publication trends and characteristics of existing research on hybrid work in agile software development?

RQ3: How have the work arrangements of agile software teams evolved during and since the covid-19 pandemic?

RQ4: What are the consequences, challenges, and opportunities of current agile software team workspaces and hybrid work arrangements?

RQ5: Which policies, tactics, and ideas can be implemented by companies to support agile software teams in hybrid work arrangements and improve the software development process?

To answer these research questions five studies have been planned, the majority of which are case studies of software teams in Denmark and Finland. The companies that have already expressed interest in participating include IBM, Valtech, Brandwatch, Ericsson, F-Secure, and Kempower, as well as five other companies which have requested they remain anonymous. These companies will be approached as case studies in accordance with the guidance of Yin Robert [29] and Verner et al. [30]. The initial research has already been carried out by performing qualitative

interviews in the Danish companies, specifically with practitioners who are in leadership and managerial positions. The characteristics and work arrangements of the software teams were analyzed, with the goal of conceptualizing the team work arrangements and identifying common patterns. These empirical activities have generated results that will provide input for the later research work. The articles and their content are briefly described below:

3.1. Article 1: The Future Workplace – Characterizing the Spectrum of Hybrid Work Arrangements for Software Teams

The first study aims to answer RQ1 and has already been published in *IEEE Software* [31]. As second author I contributed in the conceptualization and methodology, the investigation and formal analysis, and writing the original draft. The goal of this study was to offer a vocabulary to avoid the confusion that seems to prevail in the current conversations about hybrid work arrangements. This article systemizes a spectrum of emerging work arrangements for software teams (Figure 2), including *hybrid teams*, *partially aligned teams* and, *variegated teams* with fully aligned alternation of office presence. The team typology is based on practical insights from semi-structured interviews with team managers and team leads from six different companies.
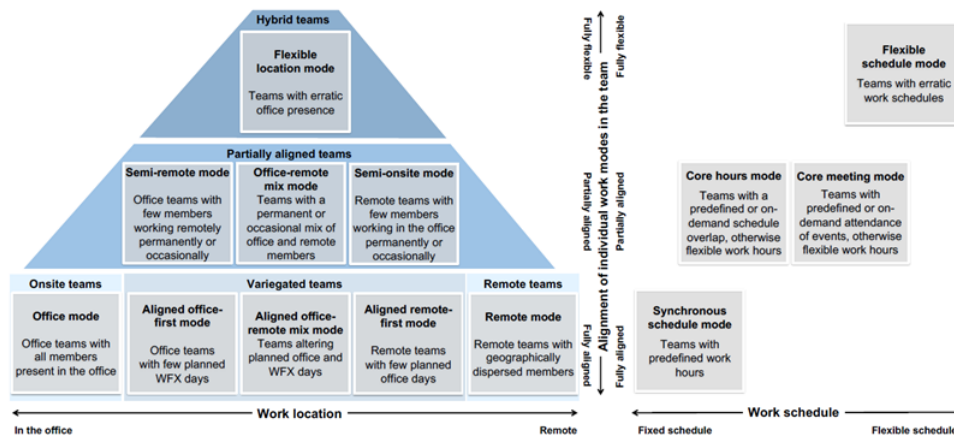

Figure 2: Team typology and the spectrum of work arrangements [31]

3.2. Article 2: Hybrid Work meets Agile Software Development – A Systematic Mapping Study

To provide an answer to RQ2 and share the findings with the research community and with the industry, one systematic mapping study was conducted to gain a good understanding of the research terrain formulated when hybrid work meets agile software development. The study has been submitted to the *International Conference on Cooperative and Human Aspects of Software Engineering* (CHASE). As second author I contributed in the investigation and formal analysis, and by writing the original draft. The systematic process followed [32, 33] led to a collection of 12 primary studies, all of which are empirical studies and the majority of these

employ case studies as the research methodology. The mapping of the primary studies included: the publication years and types of research articles; employed research methods; and the countries and organisations where the research was carried out. The research questions in the primary studies were also mapped according to a conceptual framework for organizing research questions on hybrid work in software engineering [34], and the team work arrangements were identified and mapped to the team typology in [31]. In addition, the online tools used in the hybrid settings, the hybrid work policies, and the agile frameworks, practices, and roles were identified.

3.3. Article 3: On the Evolution of Agile Software Team Work Arrangements – a Management Assessment

The third study aims to answer RQ3 and briefly explores RQ4. To gain insights and collect lessons learned on the consequences of the multitude of decisions that were taken prior to, and during, and after the covid-19 pandemic, this study investigates Danish agile software teams from seven different companies through semi-structured and structured interviews with the team leads, managers, Scrum masters, and agile coaches. To capture the various stages of the pandemic and its impact on work arrangements, a longitudinal research design was employed, and data was collected in three stages, beginning in November 2021, and concluding in May 2023 (see Figure 3).
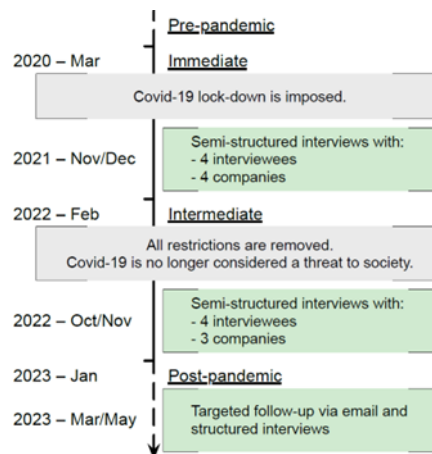

Figure 3: Overview of data collection activities (Article 3)

To familiarize with the data as suggested by Braun and Clarke [35], a light thematic analysis of the collected data was carried out using NVivo. At this stage, statements were first coded under several broad topics and later further analyzed in search for themes. Following this initial inductive process, a deductive step was followed to unify the terminology used by the interviewees. In this step, the team typology proposed in [31] was instantiated with the data which allowed a consistent view over the evolution of the described teams. The changes to the work arrangements were also coupled with insights into the work policies decided by each company. The results of the study highlight the emergence of a dynamic spectrum of work

arrangements, reflecting a newfound flexibility that accommodates a diverse array of work schedules and locations. The study also briefly explores the implications of these shifting work arrangements and policies on company, leadership and management, and team levels.

Possible Publication Venue: *Journal of Systems and Software*
Alternative Publication Venue: *Empirical Software Engineering*

3.4. Article 4: Single Case Study

This study is centered around RQ4, and the creation of a detailed knowledge base designed to exemplify the consequences, challenges, and opportunities derived from two different experimental workspaces and hybrid work arrangements for agile software teams in the Finnish R&D department of Ericsson. The study will also explore RQ5 and software process improvement ideas that decision makers should consider when dealing with various agile team work arrangements and workspaces. The company is currently in the process of changing their office workspaces and has implemented a principle that states employees should work from the office two days a week. For one group of 70 employees, these two days are not fixed, while the other group of 60+ employees are expected to work from the office on Tuesdays and Thursdays specifically. The study will investigate the impact of these two different work arrangements and the undergoing changes to the office space on company, team, and individual levels, by conducting semi-structured interviews with the employees in December-January 2023, and again in June-July 2024 to compare the results.

A particular focus will be put on investigating how the experimental work arrangements and workspaces impact team collaboration and agile practices. In addition, the study will also capture metrics to determine; the value of fixed seating and other areas of the workspace, e.g., hallways and gyms; the motivation of employees for using the office spaces; and explore tactics the company can implement to support the software teams and improve the software development process, while these changes to the workspace and work arrangements are taking place.

Possible Publication Venue: *International Symposium on Empirical Software Engineering and Measurement* (ESEM Conference)
Alternative Publication Venue: *Journal of Systems and Software*

3.5. Article 5: Multiple Case Study

This study is centered around RQ5 and is designed to further explore the various software process improvement ideas identified in Article 4 against the characteristics and arrangements of hybrid software teams defined in Articles 1, 2, and 3. The study leverages the experimentation that happened during the pandemic and is currently ongoing, by collecting software process improvement ideas and changes to the software practices in general, via surveys with multiple industry partners.

Possible Publication Venue: *Information and Software Technology*
Alternative Publication Venue: *Euromicro Conference on Software Engineering and Advanced Applications* (SEAA)

4. Timeline

The preliminary timeline for research in this project is shown in Table 1.

Table 1
Timeline

Phase	Data Collection	Data Analysis	Submission
Article 1 [31]	Nov 2021–Aug 2022	Sept 2022–Jan 2023	(Published) Mar–Apr 2023
Article 2	Sept–Oct 2023	Oct–Nov 2023	(Submitted) Nov 2023
Article 3	Nov 2021–May 2023	June–Oct 2023	Dec 2023
Article 4	Dec 2023–Jan 2024	Feb–Mar 2024	May 2024
	June–July 2024	Aug–Sept 2024	Oct 2024
Article 5	Mar–Apr 2024	May–June 2024	June 2024
Dissertation			Apr 2025
Graduation Estimate			Sept 2025

5. Expected Contributions

The expected impact of this work is to provide concrete knowledge for the case companies, and other companies, based on the findings of the research. Additionally, this project aims to provide inspiration for all practitioners in similar software engineering teams and serve as recent empirical evidence for the researching community exploring the topic of shifting ways of working in agile software development.

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