Effects of Remote Work on Communication in Agile Software Development: Is the Focus Still on People and Collaboration?

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Abstract

The Covid-19 pandemic has changed the way people work, leading to an increase in remote work. Although remote work brings numerous benefits, it also comes with novel challenges. For instance, remote work has been shown to affect communication, collaboration, and interactions. These are key aspects of agile methodologies, which are frequently used in software development. Against this background, we did a literature review to gain an overview of how collaboration is affected in remote agile teams. Our results demonstrate that, in fact, there is a loss of communication, collaboration and social interaction, potentially leading to harmful long-term effects. Among them are reduced trust, psychological safety, and engagement. In summary, we contribute to the nascent research on remote agile settings in two ways. First, we provide a consolidated overview of the intricate effects of remote work that introduces novel challenges for organizations and leaders. Second, based on our findings, we question whether the focus in remote agile work is still on people and collaboration.

Keywords: Remote Work, Agile Way of Working, Distributed Scrum Teams

1. Introduction

The COVID-19 pandemic forced many companies into an abrupt transition to remote work. Information technology (IT) businesses and software development companies have not been as severely impacted by the abrupt necessity of remote work during the pandemic, as remote work was not completely new to this industry [8]. However, even in the post-pandemic era, remote work has persisted as a prevalent trend in numerous professional sectors, especially in computer-based office work and software development [9, 16, 22]. This extent of remote and hybrid work in software development projects is new and represents a paradigm shift in the workplace [14]. Some companies are even shifting to remote-only or remote-first models, adopting virtual offices [16, 24]. While remote work offers many

benefits for both companies and employees, such as increased flexibility and savings on travel time and expenses, it also brings novel challenges. Studies have investigated the effect on productivity and well-being, with varying and sometimes conflicting results. Some show an increase in productivity and well-being, while others report a decrease [3]. For instance, the study of Butt et al. with more than 250 participants reveals a drop in software development productivity in agile development teams across industries [5].

Another ongoing trend in software development is the use of agile approaches. Especially in agile projects, interpersonal interactions and communication are central elements of the development process. For example, interpersonal interactions and communication are central tenets of the Agile Manifesto, which was written in 2001 by renowned software development experts. The focus is on individuals and interactions as well as on collaboration with customers [27].

These two trends, remote work and agile development, might be conflicting as agile was designed for face-to-face communication and best achieved through co-located teams [4, 10, 15, 19]. A lot of research has been conducted on the concept of remote work and virtual teams in general. There is less research specifically addressing remote agile teams and their collaboration. Existing research in this area often covers teams that are not fully agile but include a few agile practices. Research on how agile software development teams are affected by the transition from physical, co-located work to remote settings is still relatively rare and has received limited attention [2, 19, 23]. In this paper, we give an overview of existing research in this area focusing on how communication and collaboration in agile teams are affected by the transition from on-site work to remote work. This paper aims to answer the following research questions: *How are communication and collaboration changing in agile teams due to remote work? What are the effects of remote work on agile principles and practitioners?*

2. Literature Review

In order to provide a comprehensive overview of the changes and challenges related to communication and collaboration of remote Scrum teams, we conducted a literature review.

2.1 Procedure

The review was carried out during the latter part of 2023 and the early months of 2024. The keywords for the search query were chosen based on our research questions to ensure that the relevant aspects were covered. The initial keywords included “scrum”, “communication”, “collaboration”, remote”, “work from home”, “virtual meetings”, “virtual scrum events”, “globally distributed”, “covid-19”, and “pandemic”. Given the limited scope of the results for Scrum in particular, the research was expanded to include agile teams in general. In order to take into account the changed working conditions that have resulted from remote work in the behavior of agile teams, we have included keywords such as “change”, “transformation”, “transition”, ‘rethink’ and “lessons learned”. To combine keywords from different categories, we have used Boolean operators and refined the search terms and strings iteratively. As a database, we have chosen Scopus from Elsevier as it is one of the largest abstract and citation databases indexing high-quality and prevalent peer-reviewed papers in various disciplines. We also included the research tool Connected Papers and the AI-tool MS Copilot in our research process to identify relevant papers. However, the primary research was executed using Scopus as the principal database.

To optimize the result set, test runs were carried out in Scopus to select the keywords and to refine the search strings. The final search string is as follows:

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TITLE-ABS-KEY ( "scrum" OR "agile" )
AND TITLE-ABS-KEY ( "change" OR "innovation" OR "transformation" OR
    "transition" )
AND TITLE-ABS-KEY ( "communicat*" OR "collaborat*" )
AND TITLE-ABS-KEY ( "work from home" OR "meeting" OR "global*
  distribut" OR "remote" OR "event" OR "virtual" )
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To concentrate on current research and the changes to working practices resulting from the pandemic caused by the Covid-19 virus, we focused on publications dating from 2020 onward. Given the focus of our research on communication and collaboration, the papers selected for inclusion address team agility and teamwork. We excluded papers that did not focus on our research questions by checking titles and keywords. In the screening phase, we reviewed the abstracts of the papers based on content-related criteria. In the next step, we further excluded by reading the conclusion, and in the final verification step, we read and reviewed the entire content of the papers for relevance. However, not all papers of potential interest were fully accessible. To address this limitation, we initiated contact with the authors via e-mail or ResearchGate. This approach enabled us to obtain a subset of the relevant papers and to include them in our analysis. The refinement of the search string was a collective effort among all authors. The identification and screening of papers was primarily conducted by the third and fourth author. The analysis was conducted collectively, with the primary contribution from the first author.

The following PRISMA chart [17] visualizes the process of identifying relevant papers for our research topic.

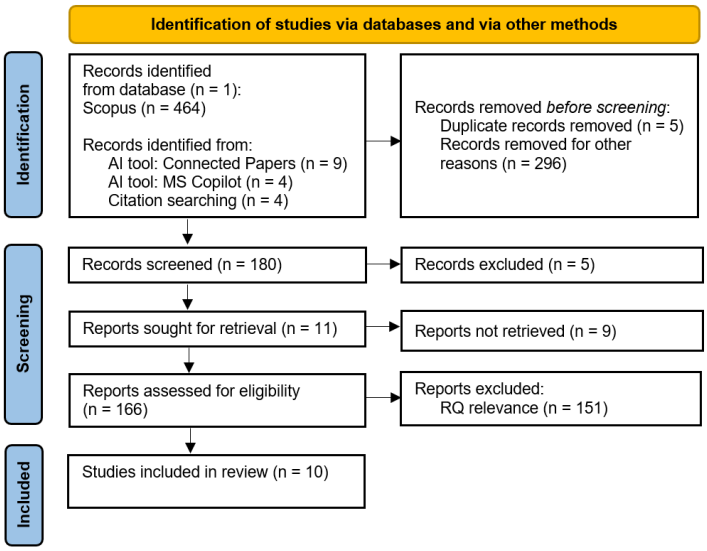

Fig. 1. PRISMA Chart [17] of the conducted literature review

2.2 Key Results

Before we present and discuss the key findings which are directly related to our research questions and therefore focus on communication and collaboration issues of remote agile teams, it is important to acknowledge that the effects of remote work are not limited to a simple binary classification but rather encompasses a broad spectrum that is influenced by numerous personal and organizational factors [1, 12]. These factors include individual characteristics, personal preferences, life situations and work environments at home. As different individuals and teams perceive the effects differently, it is only possible to detect tendencies. This also explains why the literature contains different and contradictory study results regarding the impact of remote work on productivity or well-being. Some studies show an increase in productivity and well-being, while others report a decrease (see section introduction).

In the following, we sum up the results of our literature review regarding our research questions. Table 1 gives an overview of the included papers. We identified and extracted topics related to communication and collaboration in these papers.

Table 1. Included papers with study type and focus area

Title and Source	Type of study	Focus area
Remote agile: Problems, solutions, and pitfalls to avoid [19]	In-depth case study in a company over 17 months	Exploration of how to adapt agile to remote work
Agile software development one year into the COVID-19 pandemic [1]	Mixed methods study with quantitative questionnaires and qualitative interviews	Involuntary shift to remote work and how agile practitioners have been affected in terms of ways of working
What Remains from Covid-19? Agile Software Development in Hybrid Work Organization: A Single Case Study [15]	A quantitative survey in two agile software development teams	New challenges for agile software development teams due to the high variety of work models; team member preferences
Little Stakeholder Communication in Distributed Scrum Projects During the Covid-19 Period [26]	Qualitative: semi-structured interviews with eight companies	Changes in the Scrum Master's responsibilities
Implementing Lean Principles in Scrum to Adapt to Remote Work in a Covid-19 Impacted Software Team [7]	Literature and experience report	Exploration of challenges remote teams are facing; modifications of Scrum; weakening of Scrum fundamentals
Agile software development and software practitioners' productivity amidst the COVID-19 pandemic: a narrative review [2]	Narrative literature review	Impact on productivity; adopting agile methodologies
The Effects of Virtuality on Agile Development [23]	Qualitative case study examined three agile teams	How agile development teams are affected by the transition from physical to virtual agile teamwork; compatibility of it
How Do Brazilian Software Development Teams Deal with Working From Home After a Year of the COVID-19 Pandemic? [3]	Survey with software development teams; quantitative and qualitative analysis	Investigations regarding work routine, collaboration, communication, productivity, financial assistance and software development process
Respond to Change or Die: An Educational Scrum Simulation for Distributed Teams [6]	Remote Scrum simulation with 25 teams	Teaching Scrum in a remote environment
How a 4-Day Work Week and Remote Work Affect Agile Software Development Teams [25]	Qualitative single case study with interviews and observations	Agile software development in the context of remote work and a 4-day workweek

Possible impacts of remote work on communication and collaboration in agile teams

Even though some authors mentioned positive effects on communication in remote settings, such as more formal meetings with fewer private conversations and interruptions [25], the majority identified communication and collaboration as one of the key challenges. Examples of communication and collaboration issues are described in the following section.

The authors Reunamäki and Fey did an in-depth case study in a company in Finland over 17 months and highlight five key problems, solutions and pitfalls for agile organizations in remote settings. Most of these problems deal with interaction, communication and collaboration. The following issues have been identified: a decrease in interaction opportunities among teams, a decrease in interaction within the organization, decreased engagement, meeting overload, leaders who might take more control and who provide insufficient support in remote agile settings [19].

A mixed methods study from Agren et al. with quantitative questionnaires and qualitative interviews from the year 2022 investigated the impact of the forced transition to remote work due to the Covid-19 pandemic on the work practices of agile practitioners in software development [1]. The data was collected primarily from respondents in Europe. The results of the study indicate that the aspects most impacted are communication and social interactions, while technical work aspects are less affected. The authors argue that reduced social interactions may have negative impacts on psychological safety, personalities, well-being, and teamwork in general. Moreover, they describe that remote work requires more attention on processes and tools, which makes the principle of the agile manifesto to value "*individuals and interactions over processes and tools*" [27] more difficult. The authors note that digital communication is possible, but they emphasize that it does not equate to face-to-face communication. Other findings of this study include the effects of feeling forced to work remotely, such as a reduction in the quality of communication and a decline in team morale.

While some studies investigated the impacts during the Covid-19 pandemic, other research has focused on the post-pandemic era and the resulting changes in the work environment. For example, Neumann et al. did a quantitative survey in a company with two agile software development teams. The findings of this study indicate a preference among team members for remote work in the future. However, a proportion of team members also expressed a desire to work on-site one to two days per week. This heterogeneity in workplace preferences is resulting in a hybrid work organization, bringing advantages for agile software development teams but also new challenges. The authors conclude that there is a need for change regarding office and working equipment and for software tools to support agile approaches and the adoption of agile practices [15]. According to Ågren et al., hybrid meetings are less effective and more challenging compared to meetings where all participants are either remote or on-site. Hybrid meetings would create a gap between participants who are on-site and those who are remote [1].

Another qualitative interview study of Valgeirsdóttir et al. from Iceland explored changes for Scrum teams while working distributed and how the work and responsibilities of Scrum Masters change. The paper summarizes different stances of Scrum Masters and demonstrates how this is affected when working remotely. The main result is a decrease in communication with stakeholders and users, which is essential for agile software development. The lack of communication among team members did not appear to be a problem for those teams, according to the interview participants. However, approximately half of the participants reported a decline in the flow of information and a decrease in communication between team members compared to previous levels. The fact to have not been able to meet in person was a big issue for the teams and the absence of social interactions when working remotely was the most discussed challenge of the participants in this interview study [26]. The documented decline in communication can lead to a reduction in information exchange and creativity. As stated by the author Anthony, an essential element in programming is creativity, which is cultivated through face-to-face interactions [2].

In general, there seems to be a loss in communication as well as in social interaction and possibilities for it. There are fewer informal environments and fewer non-work-related conversations, which would influence work activities positively [1, 19]. With agile approaches, regular interaction with end-users and customers is important to create high-value, human-centered products. During the pandemic, there was a reduction in this interaction, which can result in lower quality or delays in the software [2]. In addition, the lack of social interactions can have a negative impact on teamwork, collaboration, psychological safety and well-being. This, in turn, leads to a decrease in productivity. Consequently, literature underscores the significance of fostering emotional well-being among software practitioners, positing it as the most efficacious strategy for enhancing productivity [2, 18]. Psychological safety is needed in agile teams and has a substantial impact on the quality of communication. If it is missing, important discussions might not come up, which can lead to misunderstandings or missed opportunities for improvement. It might therefore have a negative impact on the team in the longer term. In remote settings, the emergence and assessment of psychological safety is difficult [1, 7]. In the context of on-site team interactions, the body language of team members serves as a crucial indicator for assessing psychological safety. The Scrum master plays a pivotal role in its identification and facilitation. In remote settings, it is challenging to gain an accurate understanding of the team's safety [7].

Conversations take place in the form of online meetings or video conferences in remote settings. In this form of communication, there is an absence or limitation of nonverbal cues such as body language and facial expressions [7, 26] which play a significant role in human communication. Additionally, remote settings can lead to meeting overload [1, 19] and fatigue caused by video conferences. Griffin points out that the nature of remote work and asynchronous communication creates an overhead that was not experienced on this scale before, and which can lead to team fatigue. This can have an impact on stress level, motivation or well-being. Other challenges of online meetings are distractions as well as multitasking, and therefore a lack of focus [7]. Teams working remotely have experienced

challenges with planning, priorities, problem solving, as well as information and knowledge sharing [1, 3]. All this is essential for effective agile teams and is connected with communication and interaction.

There was also reported a dept regarding team maturity and the onboarding of new colleagues. This concerns social integration but also the cultivation of an agile mindset [1, 13].

The authors Christensen and Paasivaara conducted and evaluated an online Scrum simulation with a multiplayer survival game for distributed teams [6]. Although the authors mention the importance of face-to-face communication, their findings of the simulation indicate that digital communication can be efficient; however, it must be learned and practiced.

Even though the effects are not binary and depend on individual and working environments, it should be observed and evaluated carefully, since many of the aspects are difficult to measure and have more long-term consequences [7]. The impacts on collaboration can influence working relationships, team morale and engagement negatively [3, 19]. This is critical to achieve agility and for the overall success of IT projects and organizations.

Most of the identified issues described above conflict with an agile methodology. In the following, we highlight these conflicts.

Remote work and effects on agile values, principles and practices

According to the analyzed literature, there has been a decline in the quantity and quality of interactions within teams, within an organization and with other stakeholders. Face-to-face conversation, which is "*the most efficient and effective method of conveying information to and within a development team"* according to the Agile Manifesto, has been largely replaced by written communication and videoconferences. Therefore, the working relationships and environments appear to be characterized by a greater degree of formality. Some teams encounter difficulties in developing a shared understanding, planning, coordinating their efforts, or establishing trust and psychological safety. The self-management of teams, which is an essential part of Scrum, seems challenging in a remote setting. It has been observed that this phenomenon leads to an increase in the level of control by leaders, which in turn has a risk of micro-management.

The authors Stendal et al. investigated how agile development teams are affected by the transition from physical to virtual work and discussed the question of whether agile development is compatible with virtual team setups. They do so by conducting a quality case study with in-depth interviews and observations of three teams in a company with experience in agile software development. They come to the conclusion that central principles for effective agile teams are affected when teams work remotely [23]. These four principles and effects on virtual teams are included in Table 1. We have expanded the table with additional elements from other sources.

Table 1. Agile way of working and effects in remote setups, expansion of [23]

Agile way of working	**Effects in remote environments**
Individuals and interactions over processes and tools [27]	More focus on processes and tools needed [1]
Working software over comprehensive documentation [27]	Increase of documentation [23]
Customer collaboration [27]	Less collaboration with users and stakeholders [26]
Face-to-face conversation [27]	Increase of written and virtual communication [23]
Informal relations [23]	More formal relations [23]
Frequent interactions [23]	Decrease of interactions [1, 19, 23]
Frequent information sharing	Reduced information flow [26]
Shared understanding [21]	Challenges in establishing a common understanding and more misunderstandings [1]
Flexible, regular short-term planning [21]	Planning and coordination difficulties [3, 5]
Self-managed teams [21]	Leaders take more control, risk of micromanagement [19]
Trust and Psychological Safety as basis [1, 7, 21]	Establishing trust and psychological safety is challenging [7, 23]
Lean thinking to reduce waste and to focus on the essentials [21]	Problems with prioritization [3] Less focus, more waste [7]

As previously stated, the Agile Manifesto's statement "*individuals and interactions over processes and tools*" poses significant challenges in the context of remote work. This is due to the focus on processes and tools rather than on individuals and interaction [1]. Griffin describes that Scrum is a framework in which people work in a highly collaborative manner and which was designed for co-located teams. Parts of the framework are optimized for in-person interaction. The author argues that this results in a weakening of the foundations of Scrum. The result of remote agile could be a more mechanical and process-oriented implementation of Scrum.

3. Discussion

Remote work represents a paradigm shift that has significant implications for the way of working. In general, remote work brings a lot of advantages for employees and companies. Nevertheless, it is influencing and restricting communication and collaboration. Communication is important for successful IT projects, especially with agile approaches.

3.1 Combination of Remote Work and Agile Way of Working

Agile methodologies emphasize collaboration, necessitating frequent interaction among team members, with stakeholders and within the organization. For example, Scrum is designed and best suited for developing complex, high-value products [21]. Such complex problems and tasks require efficient interactions and close collaboration. The Scrum Guide focuses on guiding relationships and interactions. The characteristics of Scrum are well-suited for in-person collaboration, making remote work a less optimal approach. The results of the conducted literature review demonstrate that the combination of remote work and agile practices is not ideal and that this creates a series of new challenges that need to be considered and addressed. A matter that should be evaluated is the practicality and applicability of agile principles within a remote environment.

3.2 Adaptations of Agile Work Practices

For instance, Griffin notes that modifications to the agile way of working have been implemented in order to adapt to the new normal and highlights that not all the adjustments are in alignment with the agile approach. Some of those adaptations and new work practices would create waste. The author states that a version of Scrum designed for remote teams is needed. Concrete suggestions are the automation and adaptation of Scrum events, such as doing the Daily Scrum, which aims to plan the day, not as a meeting but over instant messaging or to prerecord demos for the sprint review to focus on conversations about it [7]. Suggestions like these might result in even less interaction or in losing the focus of the Scrum events. Reunamäki and Fey mentioned possible solutions and pitfalls for the identified problems in their paper. Some of the pitfalls contradict Scrum, e.g., the creation of sub-teams, lack of respect, more micromanaging and less delegation. For solutions they, e.g., suggest promoting engagement in virtual meetings, to build opportunities for interaction, to be truly present and to adapt processes and roles to improve information sharing [19]. Griffin proposes the implementation of lean principles, with minor modifications and minimal conflicts [7]. However, Scrum is rooted in empiricism and lean thinking by design. The latter is intended to minimize waste and to focus on the essentials [21]. Nonetheless, in remote settings, the implementation and practice of lean thinking appears to be a considerable challenge. For example, another proposal by Reunamäki and Fey is to have the camera always on in meetings to improve interactions [19]. This might be good for making facial expressions visible and to foster engagement in meetings. However, it can also have negative impacts like causing stress or video conferencing fatigue, as presented in [11, 20]. These examples illustrate the considerable challenges associated with the implementation of Scrum, an agile mindset and efficient digital communication within a remote environment. It also shows that certain recommendations and modifications may be designed to address a specific issue. However, it is important to note that these measures may also result in negative consequences in other domains. Hence, it is imperative to

maintain a holistic perspective and prioritize the fundamental elements of agility.

3.3 Limitations

A substantial challenge in conducting a literature review is the identification of relevant publications. We have chosen Scopus as a database that indexes high-quality and prevalent peer-reviewed papers in various disciplines. However, publications not indexed in that database or not accessible have not been included. Another limitation might be potential biases. This risk was reduced through the incorporation of different researchers' perspectives. To not only rely on secondary data and to get contextual, in-depth insights regarding our research questions, we include primary data by conducting expert interviews, which is part of another paper.

4. Future Research Opportunities

In the analyzed papers, collaboration is often only a marginal issue. To gain a deeper understanding of it, we will integrate expert interviews. Another opportunity, in addition to this literature review and expert interviews, would be to include more databases as well as a broader quantitative validation or comparative studies across multiple organizations.

As stated above, most of the effects of remote work on team collaboration are long-term and difficult to quantify. Future research could investigate these long-term effects and evaluate whether agile values and principles can be united with remote team setups. An example of this would involve exploring the impact of reduced or missing face-to-face interaction on well-being and psychological safety within a team. More human-centered research and support for companies and employees is needed. Subsequent research should also examine the impact of hybrid work models on collaboration within software development teams.

Future research should help answer questions about how often agile teams should meet in person to work effectively and to promote productivity and well-being. An interesting question in this regard is how long the effects of personal encounters persist. This is necessary to facilitate informed decisions regarding the optimal conditions for remote or hybrid work, particularly in terms of its alignment with agile teamwork and the overall success of agile projects.

5. Conclusion

In summary, the paper at hand explores the implications of remote work on communication and collaboration in agile teams. The findings underscore the significance of this subject matter. The conducted literature review provided the initial basis for addressing the research questions. The incorporation of the results of expert interviews will further refine these responses. The analysis shows that communication and collaboration are reduced, which in turn reduces information flow, creativity, psychological safety and well-being. The effects are predominantly long-term and difficult to quantify, but are essential to the productivity and the overall success of software development projects. Originally, communication and collaboration are at the heart of an agile software development process. This paper demonstrates that this is not the case in remote agile teams, and it shows the contradictions of the effects of remote work with the agile way of working. Therefore, we question whether the focus can still be on people and collaboration in a remote work environment.

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