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Impact of Remote Work on Software Teams

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Abstract
The COVID-19 pandemic marked a significant shift in how software companies operate, with many forced to rapidly transition to remote work. This abrupt change introduced new challenges in managing development teams and maintaining the flow of knowledge within organizations. This study explores the key transformations in software development teams as they moved from traditional in-office work to a remote environment. Through a series of interviews and qualitative data analysis, the research highlights both the benefits and drawbacks of remote work in comparison to face-to-face collaboration. Additionally, the findings suggest that companies with wellestablished processes experienced fewer difficulties in adapting to the remote work paradigm. As remote work continues to evolve post-pandemic, these insights remain critical for understanding its long-term impact on software development practices. Keywords—component, formatting, style, styling, insert

Index Terms: Component, Formatting, Style, Styling, Insert

I. INTRODUCTION

The COVID-19 pandemic in 2020 fundamentally altered the global job market, leading to significant and often abrupt changes. Millions of people faced layoffs or job losses, while many others had to quickly adapt to remote work as offices worldwide shuttered [Lund et al. 2021]. This shift was particularly pronounced in highly skilled professions requiring advanced education, where remote work became the norm, with more than two-thirds of working hours conducted from home [von Gaudecker et al. 2022] limits. As we move further into the decade, it's clear that remote work is not a temporary phenomenon. According to [Lund et al. 2021], an analysis of over 2,000 tasks across 800 occupations in eight countries found that remote work can be conducted without a loss in productivity. In fact, 20% to 25% of the workforce in advanced economies is now working remotely three to five days a week, a significant increase from prepandemic levels. This shift could lead to a major transformation in the geography of work, influencing where and how work is performed.

However, this new work environment has also introduced new challenges, particularly in how companies manage their teams and projects. In sectors where knowledge is a critical asset, such as software development, understanding and addressing the challenges of remote work is essential for maintaining productivity and innovation. Given this context, the present study seeks to identify the primary changes that software development teams experienced as they transitioned from traditional in-office settings to remote work. The goal is to assess which changes have had positive impacts and which have presented challenges. This research involved conducting interviews with eight Brazilian software development companies of varying sizes and sectors, all of which have fully or partially adopted remote work. The

study aimed to answer the following question: What are the main impacts on software teams as they transition from face-to-face to remote work? This question is crucial for understanding how the ongoing evolution of remote work will continue to shape software development practices in the years to come

II. RELATED WORK

Prior to the COVID-19 pandemic, work environments were primarily categorized as either face-to-face or remote [Teevan et al. 2021]. Remote work was already a familiar concept in Distributed Software Development (DSD), where globally managed projects involved teams collaborating across different geographic locations. For such projects, various technological tools were necessary to support connectivity and facilitate social interactions [Oshri et al. 2007], alongside a mature team structure and well-defined processes. The onset of the pandemic forced many companies, including those that had never previously embraced remote work, to adopt it suddenly. This unplanned shift proved that it was possible for companies to maintain their productivity, leading to the remote or hybrid work model becoming a permanent fixture in many software development organizations. However, this new mode of working also introduced several challenges, making it essential to understand its impacts on various aspects of work. Several studies have already examined the effects of the pandemic on software teams. For example, [Oliveira Junior et al. 2020] investigated the impact of COVID-19 on the productivity of
software developers in Brazilian teams, while [Ralph et al. 2020] explored similar effects on international teams. In another study, [da Mota Silveira Neto et al. 2022] conducted exploratory research during the initial months of the pandemic, revealing that developers encountered difficulties in meeting their goals, which adversely affected productivity. They also identified challenges in communication and satisfaction with social interactions as significant impacts of COVID-19 on software development. However, studies examining the long term impact of the pandemic on software development teams are still emerging, such as those by [Ford et al. 2021], [Rahman and Farhana 2020], and [Quadros et al. 2022]. Unlike these studies, our research offers a deeper investigation through qualitative research to understand the primary changes experienced by companies as they transitioned from face-to-face to remote work. The participants in our study were already part of software teams before the pandemic, providing a unique perspective on the changes that have occurred designations.

III. RESEARCH METHOD

The study presented in this article is exploratory in nature, comprising an empirical field study conducted through semistructured interviews and analysis of discursive texts. This research involved professionals from various software development companies.

A. Research Structure

Conducting empirical research in software engineering presents unique challenges, as specific guidelines are required to ensure its validity, as highlighted by several researchers, including [Sjoberg et al. 2007] and [Perry et al. 2000]. To address these challenges, we followed the guidelines outlined by [Pfleeger and Kitchenham 2001], which detail the process of conducting research surveys in software engineering. Additionally, guidelines focusing on online surveys were considered, as presented by [Molleri et al. 2016] and [Punter et al.´ 2003], along with an exploration of standard research stages as defined by [Ghazi et al. 2019]. Despite the availability of guidelines for empirical research in software engineering, most focus on surveys aimed at collecting data from large populations. In contrast, our work follows a workflow inspired by the guidelines from [Ghazi et al. 2019] and [Molleri et al. 2020],´ aiming to conduct empirical research

based on ethnographic methods [Zhang et al. 2019]. The research steps are illustrated in Figure 1. The semi-structured interviews were designed to identify the impacts of remote work adoption on software development teams. We adhered to a predefined interview script to ensure consistency across interviews. All validations, pilots, and interviews were conducted remotely using the Google Meet platform. The interviews were recorded, and transcription was facilitated using Tactiq software. Qualitative analysis was subsequently performed using Atlas.ti version 9 [Atlas.ti 2024]. In the qualitative context, the interview texts were analyzed, categorized, and coded following [Saldana 2013]. Various coding techniques were employed, including Provisional Coding, In Vivo Coding, and Magnitude Coding [Saldana 2013].

B. Survey Demographics

The interviews were conducted with participants who were engaged in software development before the COVID-19 pandemic and subsequently transitioned to remote work. The profiles of both the companies and the respondents were diverse. We interviewed eight respondents of varying ages, genders, and positions from eight different companies, which varied in size and industry sector. Table 1 provides a summary of the respondents' profiles. The average duration of the interviews was 39 minutes.

IV. RESULTS

This section presents the findings from the qualitative analysis conducted in this study. The focus was on identifying the key impacts of the transition from face-to-face to remote work in software development teams. Through the analysis, we identified four categories and ten codes. Below are the insights gained regarding the impact of remote work on software development teams, along with the identified categories and codes. Excerpts from the interview transcripts are included, with the corresponding respondent company code as shown in Figure 1.

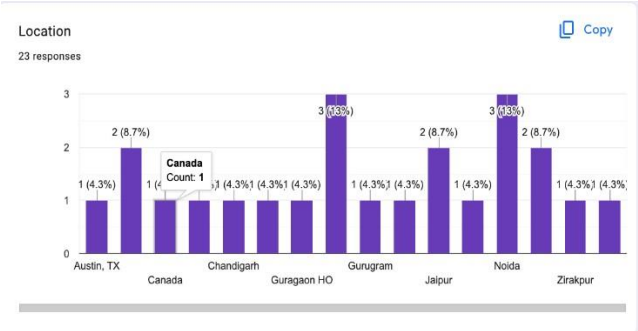
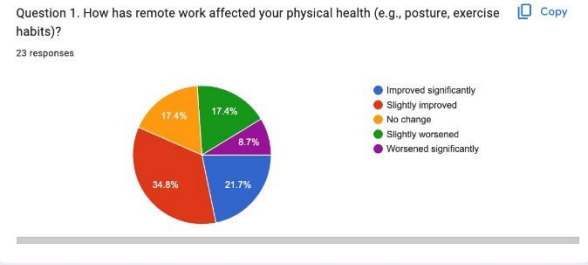


Figure-1

A. Personal

In this category, four codes were identified that relate to personal issues, either from the individual perspective or in their interactions with other team members.



B. Social Interaction

The respondents generally reported a decline in social interaction with the shift to remote work. Face-to-face work naturally promotes socialization in the workplace and during social events, such as happy hours.

Some companies attempted to mitigate the social impact by organizing online social events, but these were generally perceived as less effective than in-person interactions. Over time, participation in these online events waned.

"We started scheduling time to talk about anything other than work. At the beginning of the pandemic, it worked well, but now almost no one participates anymore." (E) Another issue noted was the loss of empathy. Online communication often lacks the human touch that face-to-face interactions provide, where one can gauge another's mood and respond accordingly. "Many people don't turn on their cameras, so you can't tell if they are happy or sad. You can't observe any human or emotional characteristics." (C) "A distance was created, leading to a loss of empathy, and relationships became purely professional. I miss the personal
contact we had in faceto-face work." (H)

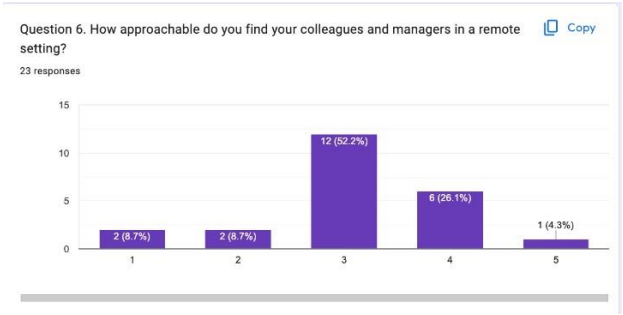


Figure-3

C. Psychological Issues

Several respondents reported feeling increased pressure due to tighter deadlines and heavier workloads, especially in the early stages of the pandemic. Two of the eight respondents were diagnosed with Burnout Syndrome, highlighting the mental health challenges associated with remote work.

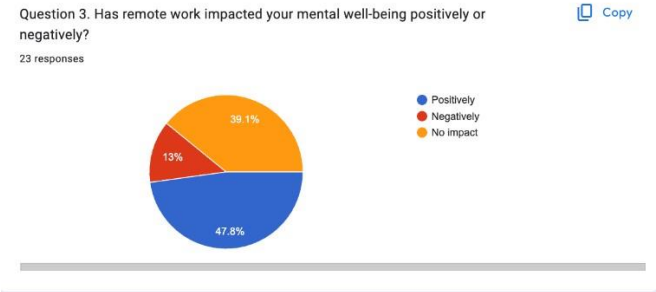


Figure-4

D. Soft Skills

All respondents noted a decline in the use of soft skills among non-management positions, such as software development roles. This issue was particularly pronounced among those who began their careers during the pandemic. Respondents observed a lack of engagement in meetings (often with cameras turned off), decreased proactivity, and shy participation. "People are often just present in meetings without turning on their cameras. I've noticed that collaboration and communication have suffered, especially for those who are not deeply familiar with their work processes. There's a general sense of disinterest, which has negatively affected collaboration and communication." (D)

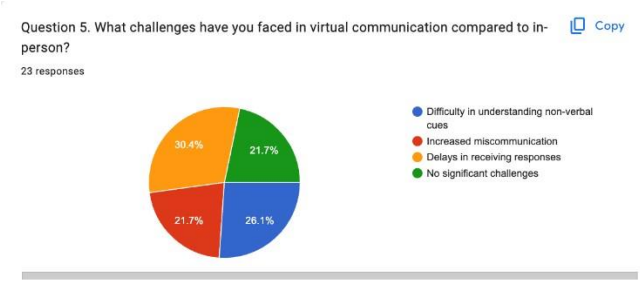


Figure-5

E. Productivity

Respondents reported an increase in productivity with remote work. The remote setting allowed for greater focus on tasks, with fewer distractions and no commuting time. “In remote work, there are fewer interruptions from people around you. The work has to be much more planned.

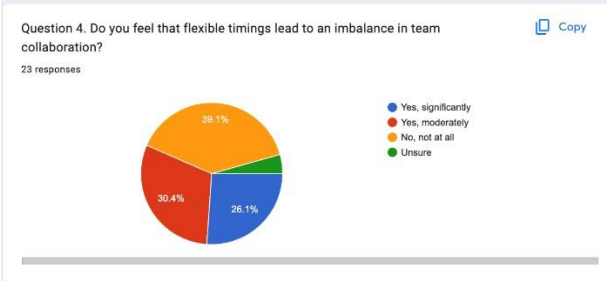


Figure-6

F. Processes

Companies with well-defined processes faced fewer challenges when transitioning to remote work. However, all respondents acknowledged that they started using new tools and features more frequently across all development stages, leading to an increase in the number of documents and artifacts. On the other hand, some companies that lacked formal processes and relied heavily on in-person socialization struggled with the transition. These teams had to improve their processes and increase their use of tools and documentation. “Some had a mistaken view of agility. Agility doesn’t mean having no documentation but having the minimum necessary documentation.” (C)

G. Resolving Doubts

In a face-to-face setting, communication is typically more straightforward, and people are more accessible. Doubts can often be resolved quickly in-person, as team members are usually working in the same office. In contrast, remote work requires scheduling conversations, which can lead to delays and an increased workload for certain roles. Respondents noted that senior positions, in particular, were slower to respond to queries

in a remote setting compared to face-to-face work. “It was much more difficult to get answers. Before the pandemic, if we had a question, we could go to a senior’s desk and get it resolved in five or ten minutes.” (F) “The communication issue was troubling. Sometimes, a question would take a long time to be answered, sometimes even the next day.” (G) On the positive side, various communication tools became more frequently used. Less critical questions were often resolved through asynchronous group tools like Discord, while more significant issues were addressed in synchronous meetings via platforms like Zoom and Teams. Project management tools like Jira and Trello also helped in resolving doubts. “When I have a general question, I put it in the devs group, and someone responds quickly.” (B) “If you have a more specific question, you can schedule an online meeting.” (A)

H. Tools, Techniques, and Methods

We identified a wide variety of tools used by software development teams, including tools for communication, collaboration, requirements management, team management, code repositories, and knowledge repositories. Additionally, teams adopted various software process practices and ceremonies from methodologies such as Scrum, XP, Lean, and Kanban, employing different artifacts at various stages of software development.

I. Teams

Team sizes generally increased, which respondents attributed to the ease of hiring during the pandemic, particularly the ability to recruit talent from other regions who were not willing to relocate for face-to-face work. However, the availability of remote work also led to increased turnover, with six out of the eight respondents having changed jobs. “The pandemic made it easier to hire specialists in Brazil. It’s no longer a problem to find qualified professionals outside the region.” (C)

J. Work Area

The final category focuses on the impact of the shift from a face-to-face to a remote work environment. In this category, we coded work environment changes. The home office setup led to a blurring of the boundaries between work and home life. Some respondents felt that there was no longer a clear division between these two spaces, leading to an increase in work hours. On the other hand, respondents appreciated the elimination of commuting time and the comfort of working from home. “People noticed that in the home office, the time they used to spend commuting is now spent working.” (C) “When traveling from work to home, you typically disconnect from work.” (E)

WORK ENVIRONMENT

The COVID-19 pandemic pushed many companies to adopt remote work, and even after the pandemic restrictions were lifted, remote work has continued as a trend. As a result, software companies are adapting to this new reality of decentralized work, which is now seen as a lasting shift (Teevan et al. 2021, Quadros et al. 2022, Choudhury et al. 2022, Lund et al. 2021). However, this transition often happened abruptly, leaving companies unprepared and forcing them to adapt without sufficient planning. This discussion aims to address the research question raised in Section 1, based on the data gathered and analyzed in the results section. It’s clear that remote work has brought many benefits for both employees and teams, but it has also introduced some challenges. In this context, respondents unanimously agree that a hybrid work model, combining remote and in-office work, is the ideal approach. This conclusion aligns with the findings of other recent studies (Choudhury et al. 2022, Quadros et al. 2022, Teevan et al. 2021). In response to the question, ”What are the main impacts on software teams due to the shift from traditional to remote work?”, the impacts can be classified as positive, negative, or neutral. Positive Impacts: Processes:Teams have become more disciplined in following processes, holding process ceremonies more consistently and rigorously. Remote work has highlighted the need for better planning and organization. Tools, Techniques, Methods, and Artifacts: The use of tools, techniques, and artifacts in software development has increased. This is due to two main factors: more complex communication dynamics in remote settings require better methods for resolving questions, and higher employee turnover makes it essential to improve knowledge management. Knowledge Management: Improvements in processes, increased documentation, and better use of repositories and management tools have enhanced knowledge management. Many companies realized how weak their knowledge management practices were only after transitioning to remote work. Team Size: Many companies reported an increase in team size. Remote work enabled them to hire skilled

professionals from different locations, contributing to this growth. Productivity: With fewer interruptions in a remote

setting, workers can focus more effectively, leading to higher productivity. Negative Impacts: Soft Skills: Employees are developing soft skills at a slower rate in a remote work environment. Resolving Doubts: The process of resolving questions has suffered, due to factors like communication issues, lack of documentation, and poorly defined processes. Psychological Issues: Remote work appears to be contributing to increased psychological challenges for employees in software development. Social Interaction : The most noticeable negative impact of remote work is the reduction in social interaction, as pointed out by all respondents. Turnover: Remote work has opened up new job opportunities, leading to higher employee turnover, which is viewed negatively by teams. Neutral Impact: Work Environment : Remote work has both positive and negative effects on the work environment. On the positive side, it allows for more comfortable and less distracting spaces. However, it has also blurred the line between work and home for many employees.

L. Work Limitations

The main limitation of this study is the relatively small sample size. However, given that this is a qualitative study aimed at gaining a deep understanding of the impact of remote work, the sample size was deemed sufficient for the research objectives. To address concerns about sample size, we carefully selected both companies and respondents to ensure representation from diverse organizations with varying profiles. Additionally, since this study focuses on qualitative insights rather than statistical validation, the goal was to explore patterns and experiences rather than prove a hypothesis, as would be typical in a quantitative study. Despite the smaller sample, consistent patterns emerged across responses, with companies of different sizes and industries reporting similar effects from the transition to remote work.

FINAL CONSIDERATIONS

This research aimed to understand how the shift to remote work has affected software development teams. It involved participants from various roles and companies, offering a broad perspective on the challenges and benefits of remote work in 2024. In summary, remote work provided significant advantages over traditional inoffice work, including increased productivity and improvements in knowledge management. However, it also introduced challenges, such as heightened psychological stress and limited opportunities for developing soft skills. Teams with well-structured processes were able to adapt more smoothly to remote work, while others enhanced their documentation and adopted new tools to address the challenges of this new way of working. The adoption of tools, techniques, and methods was essential in facilitating the transition to remote work. However, many communication

tools were insufficient for replicating the face-to-face socialization that occurs in an office environment. As a result, respondents generally favored hybrid work, which combines the benefits of remote work with in-person collaboration. Looking ahead, future research should explore the relationship between company profiles and the impacts of remote work, and examine how different tools can help mitigate the negative effects of working remotely.

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