

Impact of Remote Work on Software Teams: A Qualitative Study

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Abstract. *The COVID-19 pandemic introduced a new scenario to several software companies, which were forced to adopt home office work. The new situation imposed by the COVID-19 pandemic presents several challenges for companies, particularly in how they manage development teams and the knowledge produced. This work focuses on understanding the main modifications in software development teams when changing their work mechanisms from face-to-face to remote. A study through interviews was performed and qualitative data analysis was carried out. The results show that remote work brought both advantages and disadvantages compared to face-to-face work. Furthermore, companies with well-defined processes had less difficulty adapting to remote work.*

1. Introduction

The COVID-19 pandemic has disrupted the job market globally during 2020. The short-term consequences were sudden and often severe changes: millions of people were laid off or lost their jobs, while several others had to be adapted to home-office work quickly when their offices needed to be closed [Lund et al. 2021].

In particular, highly skilled jobs requiring a higher educational level were the ones that mostly adopted remote work, having more than two-thirds of their working hours at home [von Gaudecker et al. 2022].

It is important to note that remote working does not seem to be a passing trend. In the study presented by [Lund et al. 2021], after analyzing the potential in more than 2000 thousand tasks in about 800 different occupations in eight countries, it was verified that remote work could be done without loss of productivity. At about 20 to 25% of the workforce in advanced economies needed to work from, in an average of three to five days a week. This represents four to five times more remote work than before the pandemic and could lead to a major shift in the geography of work [Lund et al. 2021].

However, this new working scenario brought new challenges, especially in how companies manage their teams and their projects. Therefore, highly qualified sectors in which knowledge is essential, need to understand and deal with the challenges imposed by this emerging reality.

Considering this scenario, this work aims to identify the main changes in software development teams that moved from traditional to remote work and to understand which changes brought positive and which ones brought negative impacts.

The studies were conducted through interviews with eight different Brazilian software development companies of different sizes and areas of operation, which have totally or partially adopted remote work. In this way, the research conducted proposed to answer the following question:

- *What are the main impacts on software teams with the migration from face-to-face to remote work?*

2. Related Work

Until the COVID-19 pandemic, there were two ways of working: presential or face-to-face and remote [Teevan et al. 2021]. Remote work is a reality in Distributed Software Development, where globally managed projects involving two or more teams working together from different geographic locations. However, for this kind of project work, various technological means are needed to support connectivity between remote locations and facilitate socialization [Oshri et al. 2007], besides the team maturity and well-defined process.

During this pandemic, many companies that had never adopted remote work were forced to adopt it abruptly. This new scenario had proved possible for companies to continue their productive activities, and the remote model was considered to remain in software development companies, whether fully or hybrid. However, this new way of working brought new challenges. Therefore, it is essential to understand the impacts of this new model under different aspects.

Some works have already addressed the impacts of the change of work model caused by COVID-19 in software teams. For example, [Oliveira Junior et al. 2020] researched the effects of COVID-19 on the productivity of software developers in teams working in Brazil and [Ralph et al. 2020] in international teams. In another study, Silveira et al. [da Mota Silveira Neto et al. 2022] conducted exploratory research during the first months of the pandemic and revealed that the developers faced challenges in achieving goals, impacting productivity. They also identified communication difficulty and satisfaction with social interactions as impacts of COVID-19 on software development.

However, studies investigating the impact of pandemic on software development teams are still recent, such as [Ford et al. 2021, Rahman and Farhana 2020, Quadros et al. 2022]. Different from the presented studies, we proposed a deep investigation of some companies, through qualitative research to understand the main changes from face-to-face to remote work. For this reason, the research's participants already have been acting in software teams before the pandemic.

3. Research Method

The study presented in this article is exploratory, consisting of an empirical field study carried out with semi-structured interviews and analysis of discursive texts, conducted with professionals from different software development companies.

3.1. Research Structure

The process of empirical research in software engineering is a challenge, as specific guidelines are needed to carry it out, and this issue has been pointed out by several researchers, such as [Sjoberg et al. 2007, Perry et al. 2000]. To address this challenge, guidelines, as presented by [Pfleeger and Kitchenham 2001], details the research process *survey* in software engineering. Moreover, [Molléri et al. 2016, Punter et al. 2003] present guidelines focusing mainly on online surveys, and [Ghazi et al. 2019] explored several works to define standard stages of research *survey*.

Despite studies that define guidelines for applying empirical research in software engineering, most focus on surveys that aim to collect data from large populations. Thus, in this work, we follow a workflow inspired by the guidelines [Ghazi et al. 2019, Molléri et al. 2020] that aims to conduct empirical research based on ethnographic methods [Zhang et al. 2019].

The research steps were conducted as shown in Figure 1. The goal of the semi-structured interviews was to make it possible to identify the impacts that the adoption of remote work had on software development teams. For conducting the interviews we followed a previously defined interview script ¹.

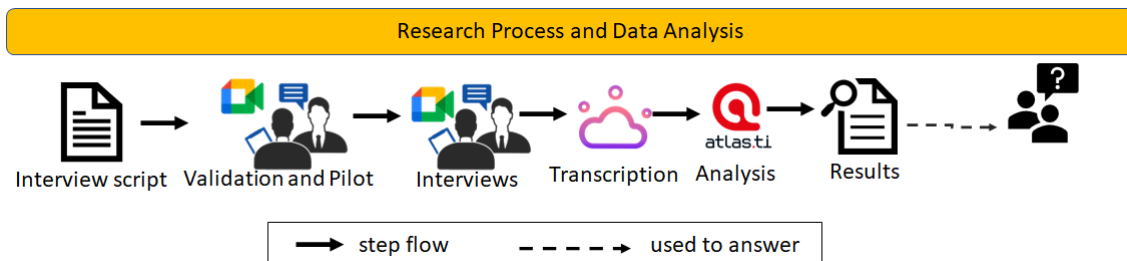


Figura 1. Research Flow Used

All validations, pilots and interviews were conducted remotely using the Google Meet tool. The interviews were recorded, and the Tactiq software was used to transcribe the interviews. Finally, the qualitative analysis was performed and the Atlas TI tool version 9 [Atlas.ti] was used for this purpose.

In the qualitative context, the texts of the interviews were analyzed, categorized, and coded [Saldana 2013]. For that, different types of coding were used, such as Provisional Coding, In Vivo Coding, and Magnitude Coding [Saldana 2013].

3.2. Survey Demographics

The interviews were conducted with participants who worked in software development before the COVID-19 pandemic and migrated to remote work. Both the profile of the companies and the respondents were heterogeneous. We interviewed eight respondents with distinct ages, gender, and position from eight different companies of different sizes and areas of activity. Table 1 summarizes the respondent's profiles. The average time of the interviews was 39 minutes.

¹<https://shre.ink/Hkte>

Co.	Position	Domain	Type	Size
A	Soft. Dev.	Agro	MN	< 20
B	Soft. Dev.	Software	MN	> 500
C	Sol. Architecture	Bank	NTL	> 500
D	Team Leader	Legal	NTL	< 50
E	Team Leader	Software	MN	> 500
F	Soft. Dev.	Software	NTL	< 20
G	Soft. Dev.	Soft. Factory	MN	> 500
H	Proj. Manag.	Data Driven	NTL	< 20

Tabela 1. Profile of Companies and Respondents
Co. Company NTL: National MN: Multinational

4. Results

This section presents the results obtained through the qualitative analysis of this study. We focused on identifying the main impacts caused by the migration from face-to-face to remote work. Carrying out the analysis, we identified four categories and ten codes.

Following are presented the insights noticed in this study about the impact of remote work on software development teams and the categories and codes identified. Excerpts from transcripts taken from the interviews are also presented, followed by the respondent company code, as shown in Table 1.

4.1. Personal

In this category, we identified four codes relating to personal issues, either from the individual himself or from his relationship with other team members.

4.1.1. Social Interaction

In general, the respondents reported that with remote work, social interaction decreased. Working face-to-face stimulates socialization in the work environment and outside, promoting social events such as happy hours. Some companies reported trying to minimize the social impact by promoting social events online. However, in general, it is not as good as face-to-face; and after a period, the participants lost interest.

“We started scheduling a time to talk about anything other than work. At the beginning of the pandemic it worked well, but today practically no one participates anymore.”(E).

Another problem noticed in this code was the loss of empathy. When people talk using online tools, they don’t care much about the other’s feelings. In the face-to-face, you could see if the person was happy or sad, and approach them according to their mood.

“... many people don’t open the camera it doesn’t show if they are happy or sad, you can’t observe a human or effective characteristic.” (C).

“...a distance was created, so the empathy ended, and the relationship became 100% professional. I miss that personal contact that I had in face-to-face work.” (H)

4.1.2. Psychological Issues

Some respondents reported they are feeling more pressure with deadlines and increased workload, especially at the beginning of the pandemic, and also reported tiredness. Two of the eight respondents were diagnosed with Burnout Syndrome.

4.1.3. Soft Skills

All respondents realized that no-management positions, such as software development, decreased soft-skills use. This situation is more severe for those who started working during the pandemic. The respondents generally realized shy participation and lack of interest in meetings (most with closed cameras); and lack of pro-activity.

"People are often in a meeting simply to be there, without opening the camera. So, I realized that some social issues of collaboration and communication have been lost, especially for those roles where the person doesn't have a deep understanding of their work process. I even notice disinterest, so in general collaboration and communication issues have been harmed." (D).

4.1.4. Productivity

The respondents reported that they realized that productivity increased in remote work. In remote work, they are more focused on their activities, with almost no distractions and no travel time.

"... in remote work, there are fewer interruptions from people on your side. Indeed, the work has to be much more planned..." (F).

4.2. Software Development

In this category, we identified four codes that impact software development, such process, tools, doubts, and teams.

4.2.1. Processes

We realized that companies with well-defined processes had less difficulty migrating to remote work. However, every respondent admitted starting to use new tools' features and using the tools more frequently (in all development stages). Moreover, it increased the number of documents and artifacts used.

On the other hand, some companies reported there was no process and almost did not use process ceremonies before the pandemic. The communication was based on socialization, and no documentation was generated. These teams had have difficult migrating to remote work, and they needed to improve their processes and increase the use of tools and documentation.

"... some had a mistaken view of agility. Agility does not mean not having documentation, but having the minimum necessary documentation." (C)

4.2.2. Doubts

Considering face-to-face work, communication is usually more straightforward and people more accessible. Some doubts can be fastly and easily solved face-to-face as all the team might be working in the same offices. On the other hand, in remote work, any conversation needs to be scheduled, causing an overload in some roles and can be much more time-consuming.

Regarding the situation, some respondents stated that some roles (especially senior positions) take a long to answer a doubt in remote work compared to face-to-face work.

“... it brought a lot of difficulty in availability; before the pandemic, when we were in the office, any doubt we had and needed to be clarified with a senior, we would go to the desk. In five or 10 minutes, it would be resolved.” (F).

“... the communication issue was very troubling, sometimes a question raised took a long time to be answered, and sometimes it was answered the other day.” (G).

As a positive impact, different communications tools started to be frequently used. Not so serious doubts were commonly solved in asynchronous group tools, such as *Discord*, and synchrony tools, such as *Meeting*, *Zoom* and *Teams* for more robust doubts. The respondents reported that software for managing teams, such as *Jira* and *Trello*, also helps solve doubts.

..”when I have a general question, I put it in the devs group, and someone responds quickly.” (B).

... ”we can schedule an online meeting if you have a more specific question.” (A).

4.2.3. Tools, Techniques and Methods

We identified the use of several different tools in the software development teams, such as tools for communications, collaboration, requirement, team management, code repository, and knowledge repository. We also identified the use of many software process practices and ceremonies, from Scrum, XP, Lean, and Kanban, and distinct artifacts in different software development stages.

4.2.4. Teams

In general, the team size grew, and the respondents attribute this to the ease of hiring people during the pandemic, especially the possibility of hiring workers from other places that are not available to change cities for face-to-face work. On the other hand, opening new positions for remote work increases the teams' turnover, of the eighth respondents, six had changed jobs.

”...the pandemic favored the hiring of specialists in Brazil, ... now it is no longer a problem to find qualified professionals outside the region.” (C).

4.3. Work Environment

The last category presents the impact realized by the change from a face-to-face to a remote work environment. In this category, we coded just *work environment*.

The home office caused confusion between the work environment and home. Some respondents felt there was no more division between these two places, causing an increase in work time. However, on the other hand, there is no lost time traveling to the office, and it is more comfortable to work at home.

“People noticed that in the home office, the time you used to spend moving around, you now use it working. . .” (C)

“...when traveling from work to home, you are generally disconnected from work.” (E)

5. Discussion and Work Limitations

The COVID-19 pandemic pressed several companies to adopt the remote-work. However, even with the end of pandemic restrictions, this reality remains. Thus, software companies must adapt to new scenarios since the decentralization of work is a trend [Teevan et al. 2021, Quadros et al. 2022, Choudhury et al. 2022, Lund et al. 2021].

However, the change in the way of working occurred suddenly in several cases. Companies needed to be prepared for this reality, being forced to adapt to the situation without adequate planning. Thus, the discussion of this work aims to answer the research question presented in Section 1, based on the data analyzed and presented in the results.

At first, it is important to ponder that remote work brought several benefits both for collaborators and teams, but also some problems. Considering this scenario, it is unanimous among respondents that hybrid is the ideal work. This finding corroborates with other studies [Choudhury et al. 2022, Quadros et al. 2022, Teevan et al. 2021] that concluded the same. To answer the question *“What are the main impacts on software teams with the migration from traditional to remote work?”*, we classified the impacts as positive, negative and neutral.

Positive Impacts

- **Processes:** teams improved the use of processes, using the process ceremonies more constantly and rigorously since it was noticed that remote work requires a better plan.
- **Tools, Techniques and Methods and Artifacts:** we realized an increased use of tools, techniques, and artifacts in the software process development. There are two main reasons for the increase. First, the communication teams became more complex, so new ways to solve doubts are required. Second, the turnover is increasing, so it is mandatory to improve knowledge management.
- **Knowledge Management:** the improvement of processes, the most significant number of artifacts used to improve the documentation, and the improvement of repository and management tools enhance knowledge management. Indeed, some companies reported that they realized how scarce knowledge management was in the software development process after migrating to remote work.

- **Teams Size:** many companies reported the size of software teams increased. Remote work was one of the responsible since it enables hiring capacitate people from other places.
- **Productivity:** remote work enables an environment with fewer interruptions, where workers may concentrate better, resulting in increased productivity.

Negative Impacts

- **Soft Skills:** many collaborators are developing soft skills with less intensity in remote work.
- **Doubts:** the process of solving doubts have been harmed. There are many reasons, such as communication problems, lack of documentation, and poorly defined processes.
- **Psychological Issues:** remote work seems to trigger increasing psychological problems in software development collaborators.
- **Social Interaction:** the decrease in social interaction is the most noticeable negative impact of remote work. All respondent in this study has pointed out this impact.
- **Turnover:** remote work provided new positions, leading to increased turnover in the teams, which is reported as very negative.

Neutral Impact

- **Work Environment:** remote work positively impacts some aspects of the work environment, such as a more comfortable place with less interruption. On the other hand, the respondents reported a loss of distinction between workplace and home.

5.1. Work Limitations

The main limitation of our study is concerning to the data sample was relatively small. However, it is qualitative research, in which the objective was to understand in depth the impact caused by the change in the work environment. We believe that the sample size was sufficient for the purpose of the research. Furthermore, as a way of mitigating the effect that the sample size could have on the results, both companies and respondents were carefully chosen, so that companies with different profiles participated in the survey.

Moreover, this is a qualitative study, aiming to bring an understanding of the situation, unlike a quantitative study which aims to validate a hypothesis statistically. Considering this, the sample size was enough, once it was recognized a pattern in the answers, and companies with different sizes and areas of activity reported similar impacts caused by the change from face-to-face to remote work.

6. Final Considerations

This research focused on understanding the impact caused by migrating to remote work on software development teams and it was conducted with people that take part of development teams in different roles and companies to present distinct points of view about the migration of remote work.

As main conclusions, we can state that remote work presented several advantages over face-to-face, such as improved productivity and forced teams to improve knowledge management. However, also bring disadvantages, such as increased psychological issues and hampered soft skills development. Teams with well-defined processes adapted better to remote work. Moreover, teams started to use more documentation and improve the development process and new features and tools to minimize the remote work effects.

Tools, techniques and methods adopted by teams helped migrate to remote work and several communication tools used by teams do not meet the need for face-to-face socialization. For this reason, hybrid work is reported as the ideal by respondents.

In future work, we intend to understand the relationships between impacts and companies' profiles; and investigate how the range of tools adopted by companies may help to decrease the problems caused by remote work.

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