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School of Engineering

Filipe Barbosa Soares da Costa

Remote work adoption among software development teams in Portugal after the COVID-19 pandemic: An empirical analysis

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Master's Dissertation in Informatics Engineering

Dissertation supervised by
Professor Doutor João Miguel Lobo Fernandes

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Statement of Integrity

I hereby declare having conducted this academic work with integrity.

I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

I further declare that I have fully acknowledged the Code of Ethical Conduct of the University of Minho.

University of Minho, Braga, january 2024

Filipe Barbosa Soares da Costa

Assinado por: **FILIPE BARBOSA SOARES DA COSTA**
Num. de Identificação: 15967911
Data: 2024.01.04 13:22:10 +0000

CARTÃO DE CIDADÃO

Abstract

Remote working is not a new concept, having become a more viable option with the advent of personal computers and high-speed Internet connections. Even so, it is safe to say that the percentage of professionals remotely working reached unprecedented proportions during the COVID-19 pandemic. Consequently, for many, this peculiar virus containment period meant their first contact with teleworking.

However, the obligation to work from home eventually came to an end, meaning that employers and employees regained the autonomy to decide together whether or not to invest in teleworking. Now, with a notable difference: both, with a few exceptions, are already familiarized with teleworking, its advantages and challenges, and the team dynamics adapted to allow for virtual communication.

It is within this post-pandemic context that this dissertation provides a comprehensive view of the adoption of remote working among Portuguese software development teams. Therefore, it intends to study the current prevalence of teleworking, the challenges posed by the coexistence of remote and in-office work, and how to make this symbiosis more effective and productive.

To attain this, 175 valid testimonials were collected through a questionnaire distributed between March and June of 2023. Analyzing the responses, it is possible to observe a significant migration from face-to-face to remote work between the period before and after the pandemic. Avoiding daily commuting and having more time for family and leisure activities were some of the primary motivations for this migration. It can be asserted that the coexistence of remote and face-to-face professionals induces a slight negative impact on team dynamics. Lastly, and with the intention of optimizing the dynamics of teams that accept remote work, a set of recommendations is presented based on the participants' testimonies.

Keywords post-pandemic, remote work, software development, questionnaire, Portugal

Resumo

O trabalho remoto não é um novo conceito, tendo se tornado uma opção particularmente viável com o surgimento dos computadores pessoais e das conexões Internet de alta velocidade. Ainda assim, é seguro afirmar que a percentagem de profissionais a trabalharem à distância atingiu proporções inéditas no decurso da pandemia COVID-19. Consequentemente, para muitos este peculiar período de combate a um vírus significou o primeiro contacto com o teletrabalho.

Contudo, a obrigatoriedade de trabalhar a partir de casa acabou por cair, dando novamente liberdade aos empregadores e profissionais para, em conjunto, decidirem ou não apostarem no teletrabalho. Agora com uma notória diferença: ambos, salvo raras exceções, estão já garantidamente familiarizados com o teletrabalho, com as suas vantagens e desafios, e as dinâmicas da equipa adaptadas à comunicação virtual.

É inserida neste contexto pós-pandémico, que esta dissertação tem como principal objetivo traçar um retrato atual da adoção do trabalho remoto entre as equipas de desenvolvimento de software portuguesas. Propõe-se, assim, a estudar qual a prevalência atual do teletrabalho, quais os desafios colocados pela coexistência do trabalho remoto e presencial, e, ainda, como tornar essa simbiose mais eficaz e produtiva.

Para tal, foram recolhidos 175 testemunhos através de um questionário distribuído entre março e junho de 2023. Analisando as respostas, foi possível observar uma expressiva migração do trabalho presencial para o remoto entre o período anterior e posterior à pandemia. Evitar viagens diárias de e para o escritório e ter mais tempo para a família e atividades de lazer foram algumas das principais motivações para essa migração. É possível afirmar que a coexistência de profissionais remotos e presenciais induz um ligeiro impacto negativo nas dinâmicas de equipa. Por último, e com o intuito de otimizar as dinâmicas das equipas que acolhem o trabalho remoto, diversas recomendações são apresentadas com base nos testemunhos dos participantes.

Palavras-chave Pos-pandemia, trabalho remoto, desenvolvimento de software, questionário, Portugal

Contents

List of Figures

List of Tables

Part I

Introductory material

Chapter 1

Introduction

Remote work is not a novel concept, having been in use in a variety of industries for decades. However, in early 2020, virtually every software development team was forced to undertake remote work in order to contain the transmission of the unforeseen SARS-COV-2 virus. Eventually, as the pressure from the infection eased and the vaccination process progressed, certain restrictions previously implemented to curb the virus were withdrawn. As a result, telework became merely recommended by health authorities before, ultimately, returning to its exclusively optional nature. Despite that, the COVID-19 pandemic catalyzed a substantial shift in the way many companies and employees perceived remote work. The lockdown and subsequent working from home experience led individuals to reevaluate their working expectations and priorities in favor of things such as flexibility, having more time for family, and avoiding the need to commute.

As of 2022, Zippia [Zippia, 2023] reports that, among the U.S. workers, 26% adopted teleworking, while prior to the pandemic period, only 6% did so. The job seeking platform also affirms that 16% of the companies operate totally remotely, and 66% of employees perform some work remotely, being IT the industry more frequently embracing teleworking. Similar results were reported by Eurostat for the EU, where the percentage of individuals between the ages of 20 and 64 years working from home rose significantly from 5.5% in 2019 to 13.5% in 2021 [Eurostat, 2022]. According to Euronews [Hurst, 2023], 30% of the European Union workforce was either working exclusively remotely or in an hybrid regimen throughout 2022.

1.1 Overview and Motivation

Remote work is a flexible way of working that enables employees to complete their duties from anywhere, alternatively to a traditional office-based work arrangement. Despite the recent interest in the topic, remote work has been around since the 19th century, when telegraph operators worked remotely to con-

trol railroads. Later on, in the 1970s, advances in satellite and network technology made it possible to build upon the idea of working outside the central office, and the term "telecommuting" was created by Jack Nilles [Newport, 2020]. However, it was not until the turn of the century that remote work became widely accepted, once again, thanks to technological advances. With the widespread of internet access and virtual meeting tools, teleworking evolved and became more similar to what we know today. The most recent revolution was brought on by the COVID-19 pandemic and consequent lockdowns, leading to the adoption of remote work by millions of workers globally.

Given this, the purpose of this dissertation is to investigate the current state of remote work in the post-pandemic period among software development teams in Portugal. Determine the dimension of the phenomenon, the challenges, and motivations associated with the adoption of teleworking, and develop strategies to mitigate any potential negative outcomes.

This study also builds on Ana Almeida's earlier investigation [Almeida, 2022], delving into the consequences of forced remote work throughout the COVID-19 pandemic on software professionals in Portugal.

1.2 Research Objectives

This dissertation should address the following objectives:

- Investigate the current state of remote work in the post-pandemic period among software development teams in Portugal.
- Determine the dimension of the remote work adoption phenomenon.
- Determine the motivations and challenges associated with the adoption of teleworking.
- Develop strategies to mitigate any detrimental effects imposed by remote work.

1.3 Research Questions

The subsequent research questions were formulated in order to guide this dissertation investigation:

1. How prevalent is remote work in the period following the COVID-19 pandemic?
2. What are the benefits and downsides associated with remote working from the perspective of the software developers?
3. How can remote work be more productive?

4. What challenges do the coexistence of remote and in-office work imposes?

5. How can the synergy between remote and in-office work be enhanced?

1.4 Document Structure

This document comprises the following chapters:

- *Introduction:* this chapter presents the context in which the dissertation is framed, as well as its motivation and research questions.

- *State of the Art:* it provides a review of prior research studies delving into the usage of remote work among software development teams. Defines the research queries to be addressed, the articles' search and selection workflow, a small summary of each publication, alongside some tables highlighting the most crucial information.

- *Methodology:* in which the data collection instrument, target population, queries to be addressed and questionnaire structure are described, in addition to a brief portrayal of the demographic data acquired.

- *Statistical Analysis and Results:* it comprises the statistical analysis workflow applied for each query, along with the corresponding outcomes.

- *Conclusions and Future Work:* in order to derive the dissertation conclusions, the research questions are addressed, and its findings are contrasted with those in the existing literature. Additionally, the study limitations and prospects for future investigation are acknowledged.

Chapter 2

State of the Art

This chapter describes the systematic literature review conducted to collect findings from prior research regarding the topic:

2.1 Research Questions

In order to successfully depict the phenomenon of the adoption of remote and hybrid work by software development teams, as well as its challenges and benefits, the literature review should address the following questions:

1. What are the perceived benefits of remote work for employees?
2. What are the perceived disadvantages of remote work for employees?
3. What are the benefits and drawbacks of having workers teleworking according to team leaders and employers?
4. How can the remote work experience be enhanced and productivity improved?

2.2 Search Approach

Between October and December 2023, several databases and libraries, including IEEE, Springer, and the ACM Digital Library, were used to conduct the literature search. However, the queries were mainly performed using Google Scholar since it provides access to these highly regarded libraries, as well as virtually all known publishers. Besides, some additional research studies were appointed while browsing the references of previously selected publications.

The following search terms were used: (“remote work” or “remote working” or “hybrid work” or “working from home” or “telework” or “telecommuting” or “work remotely” or “flexible working”) and (“chal-

lenges" or "productivity" or "job satisfaction" or "performance" or "communication" or "collaboration" or "impact" or "work-life balance") and ("software development" or "software engineering" or "software developer").

2.3 Selection Criteria

Most papers and articles were selected based on the following criteria:

Inclusion Criteria:

- Shall have been published between January 2009 and December 2022; [1]
- Shall be written in English or Portuguese;
- Shall be related to software developers/engineers;
- Shall be related to remote or hybrid work;
- If published in well-respected organizations like ACM, Springer, IEEE, ScienceDirect, Elsevier, Taylor & Francis, or another peer-reviewed only journal, shall be referenced by 25 or more other studies;
- If published in lesser-known organizations, shall be referenced by 100 or more other studies.

Exclusion Criteria:

- Articles exclusively related to distributed teams, i.e., teams divided into smaller groups dispersed among several offices, however, without employees working remotely;
- Articles almost exclusively related to new technical methodologies to adapt to remote work, such as methods to allocate tasks.

Out of the 21 articles that ended up being selected, 5 did not meet the requirements, particularly regarding the number of references. They were still chosen, since, despite the fewer citations, I found them relevant to the research.

[1] 2009 since it was the year when Skype, the most popular videoconferencing tool in this past decade, started supporting screen sharing, an essential resource for remote work, according to Cowling [2016].

2.4 Search and Selection Workflow

Having previously selected Google Scholar as the platform to conduct the search and having specified the search terms, thousands of articles were retrieved. However, reading the title, only 125 were deemed as noteworthy. Applying the more straightforward inclusion and exclusion requirements, such as year of publication and number of references, to the initial batch of articles shown for each query (since those were the most capable of fulfilling the reference requirements), 47 articles were selected. Furthermore, reading the abstract of each one and applying the yet to be used criteria, 15 of the 74 persisted. Additionally, through backward snowballing, one extra article was picked, while, among the 125 previously listed as noteworthy, 5 were appointed by their relevance to the study, despite not fulfilling the inclusion specifications. Figure 1 illustrates the workflow used to select the 21 articles.

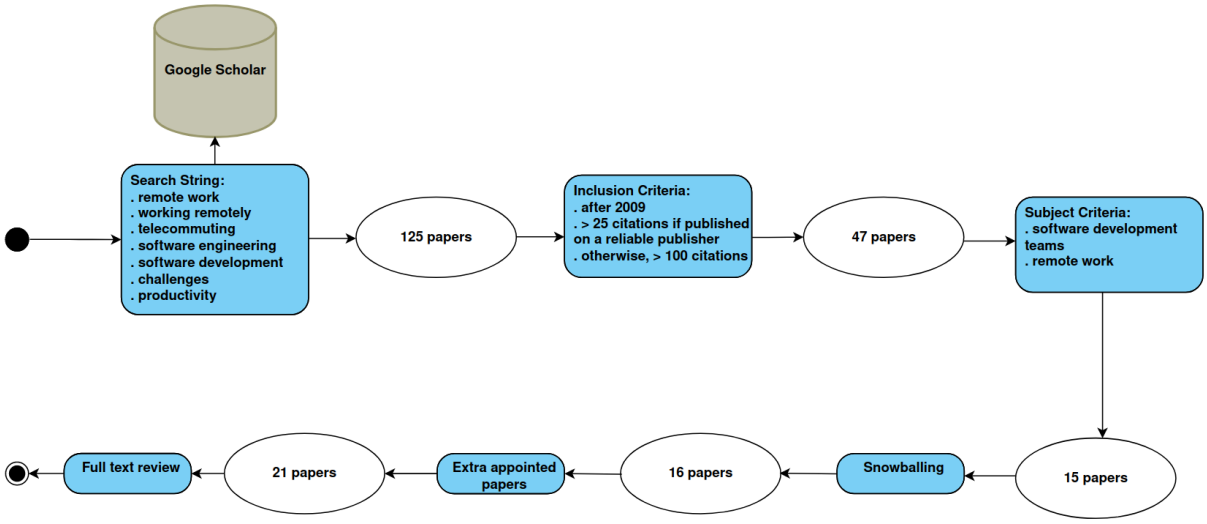

Figure 1: Search and selection workflow

2.5 Articles Overview

A brief summary of each article, as well as an overview of their overall findings, is presented in this section.

Telecommuting advantages and challenges for IT management and staff

Sikes et al. [2011] investigate the benefits and challenges of telecommuting for IT workers and managers, drawing on their own experience as managers and a literature review of previous research.

In an introductory note, the researchers list a series of qualities they regard as crucial for remote workers, such as being self-motivated and enjoying their work, having the ability to communicate frequently and assertively with colleagues, being capable of effectively self-learning new skills and having the willingness to let co-workers and managers know they are available.

They also present several advantages of telecommuting both for organizations and employers. The organizations can reduce their expenses since the need for office space decreases or becomes non-existent, the company can become more environmentally friendly and, allowing employees to have a more flexible schedule tends to increase their motivation. From the workers' perspective, telecommuting offers a flexible timetable, decreases the frequency of interruptions, allows more privacy and potentially enables a healthier work-life balance.

On the other hand, some challenges can arise from the use of teleworking. The organization may not be able to be as effective in tracking their employees' work, it often results in an infrastructure more vulnerable to cyberattacks (especially if security measures are not adopted), often times those remotely working perceive their promotional opportunities as more scarce, and technical resources such as a domestic high-speed internet connection or a VPN need to be ensured. In order to maintain an indispensable balance between work and personal life, professionals must set well-defined boundaries between work and leisure activities.

To address them, managers must effectively keep track of the work done by their telecommuting workers and ensure quality, expectations regarding efficiency should be similar regardless of whether employees are working remotely or not, frequent communication should be maintained (even scheduling some in-person meetings, if possible) and, lastly, managers should encourage the developers to seek help from each other. In summary, managers should have similar approaches and relationships with both remote and on-site workers.

Sociomaterial bricolage: The creation of location-spanning work practices by global software developers

Johri [2011] study the practices adopted by globally spread software development teams to overcome coordination and communication challenges. To achieve that, the researcher collected data through both interviews and direct observation at two internationally dispersed offices of a US tech company.

Through the collected data, it was clear that, although video conference was useful, the most commonly used communication methods were email, instant messaging, or phone calls, as they allowed the workers to easily seek help to address simple questions and to have more casual conversations. Face-to-

face meetings, at least one time a year, were stated as helpful, however, individuals were able to build healthy working relationships with their colleagues even when they had never had the opportunity to meet them in person.

Regarding work-life balance, some workers stated that being a part of a globally spread team enabled them to improve it, since they now had the opportunity to work at home or move to locations previously geographically incompatible. Furthermore, allowing their workers to work remotely has benefits, both for the employees, who experienced a boost in productivity and were now able to avoid commuting, and for the organization since the adoption of remote work lowered the turnover rate.

In summary, because of the desire to achieve work-life balance while facing the challenges imposed by working on global teams, the developers started doing "bricolage". According to the researcher, such a term means that developers creatively utilized the resources available and prioritized performing tasks, which led them to propose the use of multiple media and communication strategies.

Does teleworking negatively influence IT professionals?: An empirical analysis of IT personnel's telework-enabled stress

Weinert et al. [2014] investigate the increase in stress experienced by IT professionals due to remote work adoption. To validate the researchers' assumptions on the reasons behind this particularly negative implication of teleworking, they surveyed 57 IT workers working, at least partially remotely.

Firstly, the study's authors performed a literature review in order to understand which factors may induce the most stress and anxiety in professionals while embracing remote work. They came up with four different forms of stress: work overload, an inappropriate work-life balance, the lack of communication with coworkers and social isolation.

While analyzing the data collected through the surveys, one could conclude that the four challenges cited above explained 72.4% of the stress caused by teleworking. Additionally, it was possible to evidence that work overload was the primary source of fatigue, while only the lack of social interaction and exhaustion showed a statistically significant impact on the desire to quit teleworking and attend the office.

In order to sustain remote work and benefit from its advantages, the researchers argue that organizations should implement strategies to avoid the stress induced by it, supervise their remote workforce and provide them with training sessions.

Involuntary vs. voluntary flexible work: Insights for scholars and stakeholders

Kaduk et al. [2019] compare the voluntary and involuntary (i.e., required by the employer) implementation of remote work and schedule flexibility. In particular, study how frequently they are in use and what is the impact on employees' well-being. To achieve that, the researchers surveyed IT employees of one USA company, having collected 758 valid responses.

Of the workers surveyed, 13% claimed they had chosen to adopt a flexible schedule, while 9% were compelled to have such flexibility. When asked about the possibility of working remotely, 95% of the workers reported performing at least some of their assignments at home, 31% chose to work remotely for a significant portion of their schedule, and 14% were required to.

Mandatory variable timetables were commonly enforced to younger employees and meant working more hours than those with fixed schedules, more frequent work-family conflicts, higher turnover intentions, and increased stress.

Regarding teleworking, those required to work remotely faced more tensions between work and family life than professionals working on-site, while those more capable of preventing them deliberately performed some work at home. Meanwhile, unlike enforced flexible working hours, mandatory remote working was not strongly associated with challenges such as stress and turnover intentions. Researchers also noticed that women were more likely to report doing a substantial part of their work remotely.

Higher job satisfaction was associated with voluntary flexibility both regarding working hours and workplace selection.

In essence, this study shows that having the possibility to work remotely is common, has a positive effect on employee well-being, and reduces their intentions to find a new job. Additionally, while a voluntary flexible schedule has the potential to improve one's job satisfaction, it also may be linked with work-family challenges and a higher turnover desire. Yet, it is possible to speculate that these kinds of difficulties are not caused by deliberately having a variable schedule but, in fact, are the reason to adopt it. It is, however, clear that being required to embrace such work regimens is associated with more detrimental effects than when workers voluntarily choose them.

To flex or not to flex? Flexible work arrangements amongst software developers in an emerging economy

Conradie and de Klerk [2019] investigate the impact and adoption of flexible work arrangements FWAs, i.e., flexible working hours and remote working by software developers in South Africa. To achieve that, responses from 260 workers representing 86 different organizations were collected.

Analyzing the data, the researchers found that 78.6% of the developers inquired had access to flexible work time and remote working and that 81.6% of those adopted them. Additionally, in an effort to ascertain whether FWAs were perceived as beneficial, participants were asked to evaluate them on a scale of one to six. The results suggest that they not only recognize them as advantageous for themselves, but also for their employers (4.75 and 4.62, respectively). Furthermore, a substantial increase in engagement was noticed, as well as an increase in performance, especially among the developers adopting both dimensions of the FWAs. Working hours and employee tenure were fairly similar when comparing those adopting the aforementioned flexible settings and those not.

In summary, the authors affirm that the adoption of FWAs not only has the potential to increase workers' performance and engagement, but also allows employers to recruit from a wider talent pool and benefit from a reduction in costs associated with office space. Therefore, employers should consider allowing their workers to work from home and have flexible work-time hours.

How human and organizational factors influence software teams productivity in COVID-19 pandemic: A Brazilian survey

Bezerra et al. [2020] study how the sudden change to a remote environment caused by the COVID-19 pandemic affected the productivity of software development teams. Furthermore, they wanted to investigate how the characteristics of the developers (e.g., experience, motivation, and team cohesion) and the organization (e.g., work environment and team size) affected productivity. To achieve that, the researchers conducted a survey in 2020 with Brazilian software development teams.

Analysis of the data collected indicated that more than 60% of respondents had never worked remotely prior to the pandemic and that experience had a positive effect on performance. While 58% affirmed that their work routine did not change due to the shift to telework, the others reported that an increased workload, more domestic or family tasks, and psychological challenges forced them to introduce changes to their day-to-day routine.

A significant number of professionals reported that team collaboration and communication with col-

leagues were good or excellent (93% and 84.5%, respectively), however, an unnecessarily high number of meetings were scheduled. Regarding well-being, more than 80% were motivated, despite often feeling anxious, exhausted or lazy. To mitigate these challenges, some strategies were consequently implemented, such as exercise or mediation. A little over half of the respondents were helped by their employer to build a proper setup for teleworking. Overall, and despite challenges such as distractions and not having an appropriate work environment, almost three-quarters of the participants claimed to have good or excellent productivity, while only 5% rated their efficiency as unsatisfactory.

To improve the remote work experience, individuals affirmed that their employers must provide mental health support, financially assist the switch to teleworking and schedule fewer meetings.

The Sars-Cov-2 pandemic and agile methodologies in software development: A multiple case study in Germany

Neumann et al. [2021] study the effects of the pandemic and the shift to forced remote work on software development teams adopting agile methodologies in Germany. To achieve that, they conducted a multiple case study of three companies, using interviews, observation, and analyzing documentation.

Scrum was the most frequently adopted agile methodology, applying practices such as daily stand-up meetings or pair programming. Regarding performance, none of the teams decreased their efficiency, and, in fact, several participants claimed their productivity increased with the shift to teleworking. To explain such occurrences, the authors presented some additional information. The process became more transparent (e.g., the Kanban boards and communication were switched to digital tools, and because of that, more team members gained access to them); there were fewer interruptions and more efficient meetings; and the use of virtual communication made it easier to include product owners.

Communication also became more objective and optimized, however, social exchange and interactions decreased in frequency, because things like lunching with colleagues were no longer possible. To address this, some teams started to arrange meetings exclusively dedicated to fostering socialization. Ultimately, conflicts did not increase, and agile practices like pair programming were still being used.

Virtual teams in times of pandemic: Factors that influence performance

Garro-Abarca et al. [2021] analyze the factors that influence the performance of software developers while working within virtual teams. They examine a questionnaire with a sample of 317 members of software development teams that, during the early months of the COVID-19 pandemic period, were forced

to work remotely.

Firstly, they conduct a literature review to identify factors potentially influencing performance. Doing that, researchers are able to identify 3 groups of factors: Inputs (i.e., communication, trust, and leadership); Processes (either task-oriented or social-emotional); and Outputs (i.e., performance, productivity, and quality of the product). Furthermore, they formulate several hypotheses to be tested based on the data collected through the questionnaires.

Overall, developers regard virtual teamwork as an excellent method and affirmed that the use of agile methodologies was helpful in the distribution of tasks. Additionally, avoiding the need to commute emerged as a clear advantage of teleworking, however, it became evident that being trusted by their managers was crucial in order to benefit from the remote work experience. Ultimately, after the switch to a virtual work environment, cohesion was strengthened and developers were convinced that not attending the office was not counterproductive. Therefore, most of them stated they were considering working exclusively remotely or in a hybrid setting in the post-pandemic period.

The hypotheses previously theorized are tested employing structural equation modeling to the data collected.

When it comes to productivity, being trusted and task features (i.e., the communication strategy applied for each type of task and the quality of the requirements) were identified as the factors with more impact on performance. Furthermore, the professionals' empowerment, team cohesion and effective communication had positive effects on productivity. However, as maintaining cohesive teams might be challenging, the researchers claimed that it may be helpful if workers are familiarized with the groups' tasks and if they find them rewarding.

In line with the aforementioned findings, the authors emphasize that the team leader must generate confidence, and ensure trust among team members. Moreover, any strategies employed to improve leadership, communication, the characteristics of tasks, or cohesion should always prioritize fostering trust.

Predictors of well-being and productivity among software professionals during the COVID-19 pandemic – A longitudinal study

Russo et al. [2021] use a two-wave longitudinal study to examine the effects of the COVID-19 pandemic on the well-being and productivity of remote software developers. The data collected in the first wave was used to build a correlation study, while the second one selected the variables related to well-being or productivity and tested them for causal relations. Despite being unable to find any meaningful correlations, through the use of multiple regression analyses, some interesting results were obtained.

Between the two waves, only stress and socialization significantly predicted well-being, while the ones with more impact on productivity were the ability to communicate effectively, competence, tediousness and distractions (the last two producing detrimental effects, as expected).

When comparing the means between both stages, the researchers found that well-being and the quality of social contacts increased as time went by. However, loneliness and communication efficiency with both managers and colleagues decreased. Ultimately, they affirm that being an extrovert helped with well-being and that, over time, the engineers were able to adapt to the challenges imposed by the enforced teleworking reality.

Some noteworthy relations are identified to understand how performance may be impacted. Therefore, one can conclude that well-being and productivity are positively correlated, and that pressuring developers to accomplish tasks may not be the best strategy to enhance their efficiency.

Researchers also present some recommendations to improve the remote work experience, such as allowing engineers with a higher degree of flexibility and autonomy to schedule their work, scheduling informal meetings during work hours, making sure introverts are involved, checking if every engineer has access to an appropriate and distraction free space to work at home. Engineers themselves should practice stress reduction methods (e.g., meditation), define a daily routine (not only for work but also for more personal activities) and have enough hours of sleep. Despite these recommendations, it is critical to get feedback from the engineers and to adjust the strategies accordingly to their individual needs.

Towards accessible remote work: Understanding work-from-home practices of neurodivergent professionals

Das et al. [2021] analyze the impact of remote work on people with disabilities such as Autism Spectrum Disorder (ASD), Hyperactivity Disorder, Dyslexia, Anxiety, and Depression. To achieve this, 36 interviews with professionals with such disabilities working from home during the COVID-19 pandemic are examined.

Regarding their home work environment, telecommuting not only allows them to avoid the distractions often imposed by the office environment, but it also helps to escape the feeling of being watched and judged by others. However, creating an adequate and distraction free work space might be challenging, especially when it is used both for work and relaxation.

When it comes to communication, the absence of nonverbal cues frequently made it difficult to read the mood of their coworkers during virtual meetings, so they often requested them to turn on their cameras. In spite of that, this strategy could potentially introduce challenges, such as seeing bright colors

on colleagues' backgrounds, which, in conjunction with background noise from others' microphones, often imposed distractions. Additionally, they experienced some challenges understanding when to speak without talking over someone else, so they often used the hand raise feature or asked questions via chat. Meanwhile, participants with dyslexia felt more comfortable using voice communication or dictation features. Therefore, in order to help them overcome such issues, respondents suggested receiving plans and relevant resources before and after each meeting.

Fatigue due to an increased volume of meetings and tasks to do was frequently felt, as well as a lack of in-person interactions, resulting in some detrimental effects on their mental health and well-being. On a positive note, having a more flexible work timetable was beneficial, and, according to participants, organizations offered more support regarding mental health than before the pandemic.

Lastly, the researchers suggest some strategies, such as integrating access technologies into virtual tools and adapting the practices to the needs of such professionals (e.g., sending agendas before and reports after meetings, trying to have more people use webcams, ensuring some rest time between conferences, or enable everyone to talk). Meanwhile, and despite these recommendations, it is crucial to notice that neurodivergent people often have distinct needs.

Returning to the office during the COVID-19 pandemic recovery: Early indicators from China

Wang et al. [2021] examine the factors influencing employees' decisions on how to arrange their work schedule between working at home or on-site when the organization was reopening its offices post-pandemic. To achieve that, the researchers conducted a survey and interviews with knowledgeable employees working in China for a multinational technology company operating in hybrid mode for over three months.

While analyzing the survey and interviews, it became evident that the hybrid regimen emerged as the most popular among the respondents (nearly 70%), with most of them attending the office three days a week. Conversely, the remote arrangement, the least popular, was only adopted by approximately 10%. Interestingly, individuals often believed it was up to them to decide whether they wanted to work remotely or on-site, and a significant portion of them tried to synchronize in-office work days with their coworkers.

The more adequate and equipped workplace setup, attending in-person meetings and having social interaction with colleagues were identified as advantages of attending the office. On the other hand, not having to commute, being able to enjoy more time with family members and taking care of them, and being more easily focused were frequently pointed out as reasons to work remotely.

Concerning productivity, most participants did not notice a significant decrease in efficiency throughout the enforced teleworking period. In fact, several were even capable of increasing it, despite missing the office facilities and atmosphere, in addition to reporting a lack of physical interactions with colleagues. In the subsequent period, when it was again possible to attend the office and benefit from its environment, the use of the hybrid arrangement was considered by almost half of the participants as more productive when drawing a comparison with the pre-COVID times.

To summarize, most respondents stated that they want to work in a hybrid mode since it can combine the advantages of working remotely and on-site, especially being able to socialize with colleagues.

A tale of two cities: Software developers working from home during the COVID-19 pandemic

Ford et al. [2021] capture the experiences of software developers working remotely during the pandemic and provide a perceived productivity comparison between working on-site and working from home. To accomplish that, two surveys were conducted among Microsoft Employees. The first one, developed to compile the advantages and challenges faced by the developers, received 1369 responses. The second one, specifically focused on evaluating the impact of those advantages and disadvantages, gathered 2265 replies.

When it comes to productivity, most participants either did not perceive a significant difference, or were able to become more efficient while working from home. Moreover, when comparing the testimonials between both surveys, one could conclude that the number of professionals reporting a decrease in performance decreased over time.

According to the respondents, working remotely allowed them to spend more time with their family members, sleep more, do more exercise, have a more flexible and personal work schedule, reduce distractions, attend fewer meetings, enjoy a more personal workspace, wear comfortable and casual clothing, and saving both time and money avoiding commuting. On the other hand, teleworking imposed challenges, such as a lack of social interactions, a fragile work-life balance, having equipment with poor ergonomics, struggling to stay properly informed about colleagues' work, having their children at home, and doing less physical activity.

Therefore, workers submitted some recommendations, such as providing more and better hardware, upgrading the connectivity, having financial support to have an appropriate work setup at home, fine-tuning the virtual communication tools and having fewer meetings.

As expected, some employees reported opposing experiences regarding factors, such as their abil-

ity to remain focused, the number and frequency of meetings, their personal motivation and, perhaps surprisingly, the possibility of avoiding daily commuting, since some perceive that time as crucial to relax.

The reporters had the opportunity to track and examine performance metrics, particularly the number of pull requests made by the developers working at Microsoft. Doing so, they did not detect any considerable decreases in their frequency.

Please turn your cameras on: Remote onboarding of software developers during a pandemic

Rodeghero et al. [2021] surveyed 267 new hires integrated into Microsoft software development teams to understand the effects of the COVID-19 pandemic and remote work on their onboarding process.

When facing issues, developers undergoing an onboarding process were often not comfortable asking for help, both due to the absence of a proper connection with their team and because they deemed those simple questions as not worth bothering others. However, they say the same doubts would be effortlessly clarified if working in the office. Explaining this phenomenon might be the infrequent use of cameras while meeting, since it was often described as one of the reasons behind the lack of team connections. Additionally, and according to the respondents, documentation was scarce and a platform to check for commonly asked questions did not exist. Such challenges may have led to some easily avoidable and straightforward technical issues.

When asked about the efforts conducted by the team to make them feel comfortable, the most common strategies cited were having regular 1:1 meetings with managers, an introduction meeting with the team, having colleagues frequently checking if the new members needed any help and having the manager assigning a team member to guide the onboarding process.

Despite the several difficulties encountered in communicating with their colleagues, the majority (83.3%) of the participants still felt connected to the team. Helping that might be the scheduling of casual activities such as online game nights.

To conclude, the authors propose some recommendations to improve the remote onboarding process. New hires should be encouraged to ask for help whenever they feel like needed, everyone must use their webcam while participating in virtual meetings, 1:1 conversations both with managers and colleagues should be frequent, they should get help to know the organization, team building activities need to be scheduled to foster team connection and cohesion, they should have a buddy and technical mentor to help with career growth and challenges during the onboarding process, the process can be customized and adjusted to their familiarization pace and prior experience, and, as mentioned before, documentation

must be accessible and up to date.

Challenges and gratitude: A diary study of software engineers working from home during COVID-19 pandemic

Butler and Jaffe [2021] study the challenges faced by 435 Microsoft engineers in the first ten weeks of remote work by asking them to write their experience in a diary every night. A survey was later conducted to gather feedback on the overall experience.

They conclude that participants were commonly experiencing both mental and physical pain (caused by the lack of exercise), feeling overworked, being unable to properly manage their work-life balance and reporting an excessive number of meetings. When comparing the reports made by managers and engineers, the former ones faced more challenges, particularly regarding their mental health, meetings or overworking. Engineers, in turn, more frequently expressed having an inappropriate workspace and a poor internet connection.

On the other hand, teleworking also allowed participants to spend more time with their family members and to avoid the need to travel between home and the worksite. Teams also became more supportive, and better management was possible.

"How was your weekend?" Software development teams working from home during COVID-19

Miller et al. [2021] examine how the shifts in team communication caused by the pandemic affected productivity and culture within software development teams. To accomplish that, two surveys were conducted at Microsoft. The first, carried out at the beginning of the pandemic, intended to gather the challenges faced by the developers, while the second aimed to do a quantitative analysis of the factors previously collected.

In regards to productivity, 56% of participants did not experience significant changes in their efficiency caused by challenges introduced by the enforced teleworking (such as childcare concerns, an increased number of meetings, and challenges to communicate and coordinate with colleagues). Despite that, the second survey revealed that 3% more respondents perceived a decrease in productivity than those capable of increasing it (23% and 20% respectively).

Most developers did not experience any changes in their team's culture and felt supported by their colleagues. However, it was frequent for them to face a lack of connection with coworkers and an absence

of social interactions (74% respondents), particularly more casual and informal ones. Collaboration and communication were also often deemed suboptimal, particularly with regard to its quality rather than frequency. Furthermore, the developers reported a lack of visual clues, challenges to brainstorming (57%), trouble following their colleagues' work (58%), and a social disconnection with their team.

To conclude, the researchers offer several recommendations to foster team culture, such as allocating ten minutes fully oriented to more casual social interaction at the beginning and end of each meeting, and scheduling social activities such as playing games within working hours. Suggestions to improve communication are also stated, such as ensuring everyone can speak, having one-to-one meetings between developers and managers on a weekly basis, scheduling recurring team gathering sessions, and having communication guides such as tools to be used and expected time for responses.

Agile working during COVID-19 pandemic

Schmidtner et al. [2022] evaluate the impact of the COVID-19 pandemic and, consequently, the adoption of remote work on agile software development teams. To achieve that, they conducted an online survey in Germany having collected reports from over 170 participants, mostly in management roles.

As expected, when comparing the remote work prevalence before and after the COVID-19 outbreak, one can observe that the usage of teleworking among developers significantly increased. In fact, while only 5% did a major part of their work remotely prior to the pandemic, that percentage reached 66% after the introduction of several virus containment measures, such as the lockdown.

Participants were also asked to rate their productivity and projects' agility both prior to and after the pandemic, using a scale from 1 to 5. Therefore, the researchers observe that while agility increased slightly (from 3.3 to 3.5), productivity had decreased (from 3.7 to 3.4). According to the respondents, flexibility was also enhanced, mainly due to the adaptation of flexible timetables. When predicting the future of remote work, they expected the percentage of developers working remotely after the pandemic to increase.

Lastly, some recommendations are proposed, such as scheduling activities to foster team spirit and the use of brainstorming sessions. The authors further suggest that the revolution in question may allow for an expansion of the talent pool, as well as making it more geographically dispersed.

How a 4-day work week and remote work affect agile software development teams

Topp et al. [2022] investigate the effects of remote work and a 4-day work week on agile software development teams. To achieve that, seven interviews and an analysis of 8 projects were conducted, in addition to observing 14 agile practices within a company with approximately 1000 employees and departments spread across four different countries. A large percentage of developers began working remotely due to the COVID-19 pandemic, and since the beginning of 2021, a 4-day week of work was being tested.

The researchers observed that some adjustments were made to the agile methodologies and practices used. Sprints were shortened from two weeks to only one, resulting in quicker planning and review meetings. Consequently, as meetings became more coordinated and focused on the project, communication improved since fewer interruptions and private conversations occurred. Some positive effects were also noticed on productivity. In fact, six out of every seven employees claimed to be capable of maintaining or even increasing their perceived efficiency. Explaining such phenomenon seems to be the quieter work environment and the reduced number of interruptions, according to their reports. It is also noteworthy that the company provided financial support to acquire the equipment needed to set up a proper workspace at home.

When it comes to the well-being of the employees, the aforementioned increase in productivity, the no need to commute and the possibility of adopting more flexible schedules, allowed for some positive effects on both job satisfaction and motivation. Meanwhile, an increase in stress also occurred among some workers, mainly due to the adoption of a 4-day work week. Regarding the team's social culture, while participants affirmed their relationships with colleagues remained unchanged or only deteriorated slightly, they occasionally chose to skip meetings oriented towards fostering socialization and cohesion. According to them, they opted to use that time to work and, consequently, be more capable of meeting deadlines.

In summary, one could conclude that both models had a positive effect on both job satisfaction and productivity. To improve their effectiveness, the researchers recommend the implementation of workshops and on-site events to foster social interaction.

How does working from home affect developer productivity? – A case study of Baidu during the COVID-19 pandemic

Bao et al. [2022] compare the developers' productivity between working from home or on the worksite

using a quantitative approach, instead of the usual qualitative analysis achieved through surveys and interviews. Using a dataset of developers' daily activities from Baidu Inc., a major Chinese IT company, they collected 4000 records of 139 developers and 138 days, 1103 of those records submitted when developers were remotely working.

The data made it possible to gather several metrics classified according to the work location (home or on-site) and the year the project was created, consequently allowing to compare the work efficiency between both environments.

When working remotely, there were fewer compilations, lines deleted and lines added. However, the success rate of release was higher when working on-site, potentially because releasing a project requires more communication. Meanwhile, the success rate of build was essentially the same whether in-office or teleworking. Productivity decreased significantly more on newer projects, as they often require more schedules and have more tasks to be performed. One could also observe more detrimental effects on larger projects while embracing remote work.

With this being said, the researchers affirm that whether developers are working remotely or on-site, their average productivity remains fairly similar.

Changes in perceived productivity of software engineers during COVID-19 pandemic: The voice of evidence

Smite et al. [2022] compare the self-reported productivity of software engineers while working on-site before the pandemic and while remotely working throughout it. To achieve that, they analyzed six surveys carried out, independently from this study, by four companies from Scandinavia between May 2020 and April 2021, as well as seven other surveys. Additional interviews with representatives from the organizations studied were conducted.

Among the thirteen surveys, the productivity reports were quite diverse and heterogeneous. However, whenever one was composed of two waves, the second one always reported more favorable results regarding performance. This phenomenon, in conjunction with the observation that later surveys also presented more satisfactory reports, led the researchers to conclude that teams were capable of properly adapting to the remote work experience. To achieve that, the authors theorize that crucial adjustments to the number and frequency of meetings were made, along with setting an adequate and fully equipped workspace at the workers' homes.

Due to the fact that some surveys reported a decrease in productivity, researchers identify the following factors as reasons that led it: increased stress and distractions, poor home office ergonomics, interruptions

caused by family members, issues with poor connectivity, mismatched working hours with colleagues, challenges to maintain an optimum communication, blurring of the boundaries between work and personal life, isolation, lack of the energy found on office, increased in the volume of work and in the number of meetings, and a lack of socialization with colleagues.

Furthermore, and sometimes contradicting the aforementioned challenges, they also identify factors that potentially increase productivity, such as having to deal with less stress, no need to commute, fewer interruptions and therefore more easily being focused, having more efficient meetings, working in a more comfortable environment, having a better work-life balance and having more flexible work schedules.

In summary, the authors affirm that there is no cause for concern regarding the adoption of remote work since teams succeed in adapting to its challenges and, hence, are successfully capable of being productive. However, and due to the fact that teleworking may deteriorate one's mental health and relationships within teams, employers should adjust their work policies to the needs of each worker, ensure they have an adequate and fully equipped workspace at home, monitor the long-term effects of remote work and foster collaboration within distributed teams.

Analysis of the impact of remote work on Portuguese software professionals during the COVID-19 pandemic

Almeida [2022] investigate the effects of the transition to remote work caused by the COVID-19 pandemic on software professionals in Portugal, with a particular emphasis on productivity and how it correlates with having dependants and assistance from household members. A survey was conducted, collecting 176 valid responses, and the data used to address ten research questions.

The analysis revealed that there was a chance that having dependants imposed adverse effects on productivity and that changes in performance were felt when working extra hours. Furthermore, the implementation of strategies intended to maintain productivity was slightly successful. As expected, workers who had worked remotely before did not increase the frequency of using teleconference tools as much as the ones who only had worked in the office.

Individuals who did not feel safe returning to the office full-time frequently claimed that they would prefer to work remotely, whereas feeling more at ease with attending the company facilities was associated with a higher likelihood of selecting the hybrid arrangement. To explain such observation, the researcher affirms that the hybrid regimen would offer both the benefits of working at home and in the office. Although the vast majority of workers who had to spend more time commuting stated that they would like to work remotely (be it full-time or in a hybrid schedule), a similar trend was noticed among workers who only

needed under 30 minutes to commute, meaning that commuting times do not significantly influence their work regimen priorities. Having to take care of dependants was slightly linked with a preference to work on-site, possibly because carrying out those responsibilities while remotely working may have been challenging.

These findings were later summarized in an article published as part of the CIBSE 2023 ([Almeida, Cunha, and Fernandes, 2023]).

Work from home & productivity: Evidence from personnel & analytics data on IT professionals

Gibbs et al. [2023] study the potential changes in productivity during the remote working period caused by the pandemic among more than 10,000 employees in an IT company based in India. The research uses data provided by the company, including employees' output, tracking of the applications used on their work devices, work time for 17 months, data about meetings and employees' general information. According to the authors of the study, the use of rigorous employee performance metrics, instead of the usual surveys, can more effectively avoid biased responses.

The results indicate that, despite being able to deliver a fairly similar output, workers had to work more hours (1.6 to 2.1 hours per day) in order to comply with their tasks, hence, it is possible to confirm that productivity decreased with the transition to working from home. Such unintended extensions of their work timetables were more pronounced among professionals with children, women even when they are not responsible for child care, and among the most experienced employees. The data also suggests that smaller teams were more successful in maintaining a similar degree of productivity when compared to the pre-pandemic period.

As expected, there was a significant increase in the time spent in virtual meetings, as they became more frequent. They also saw their length shortened, despite the fact that more participants were now involved. It was feasible to observe a reduction in uninterrupted working time, one-to-one and coaching dialogues, and networking. Regarding managers, they dedicate more time to managing groups rather than individual employees, and the periodicity of meetings with their participation increased.

In summary, the researchers conclude that due to an increased number of meetings, a struggle to maintain focus and a decrease in direct communication with colleagues or managers, employees started working more hours in order to fulfill deadlines.

2.6 Literature Review Conclusions

Overall, and taking into consideration the research questions propounded previously, the systematic literature review analyses the 21 articles, succinctly presented in Table 1.

Several benefits and challenges of remote work adoption by software development teams were identified and summarized below in Table 2. The ability to avoid commuting, have more flexible work schedules, deal with fewer interruptions and distractions, have an improved work-life balance, spend more time with family, have fewer and more effective meetings, and enjoying a more private workspace are among the benefits that the employees most frequently mentioned. However, the teams have to deal with a number of challenges imposed by remote work, such as having trouble avoiding distractions, a decline in socialization, work overload, a lack of communication with coworkers, an increase in the meetings' frequency, not having an appropriate work environment and space, struggling to balance work and personal life and having too many meetings, to name a few of the more repeatedly mentioned challenges.

Furthermore, some pros and cons of implementing remote work from the employers' point of view included a decreased turnover rate, the ability to hire talent previously unreachable, and a reduction in office space costs. On the other hand, some teams became more socially disconnected, and tracking employees' work may become more challenging. Table 3 provides a brief overview of them.

To address the challenges felt by employees, multiple strategies are suggested by the researchers, primarily aimed at the organizations and managers. The most frequently recommended ones were to schedule activities to promote socialization, offer financial aid to set up adequate homework spaces, adjust practices to meet the personal needs of each worker, and ensure everyone is able to participate and ask for help. Such suggestions are succinctly listed in Table 4.

The studies reached a variety of conclusions. However, probably the most important ones likely revolve around productivity. In that regard, studies frequently reported contradictory findings. Yet, it was more common to discover that productivity either did not change, decreased slightly, or even increased rather than experiencing a significant decline. Additionally, Smite et al. [2022] concluded that, as the weeks of remote work adoption progressed, productivity increased, suggesting that the teams were able to adapt over time. Furthermore, some groups claimed that they managed to remain connected and maintain effective communication, even though remote work had a negative impact on team culture. A few studies indicate that motivation has generally stayed the same or even increased over time, while no significant and widespread impacts on employees' well-being are reported by the researchers. Table 5 presents an overview of each article's findings and conclusions.

In essence, it is possible to conclude that, despite the challenges it may present, the adoption of remote work by software development teams can potentially have positive effects on both well-being and productivity. Employers may also experience beneficial outcomes like lowering the turnover rate and broadening the pool of potential recruits. It is crucial to note, however, that what may be perceived as advantageous for some, may be challenging for others. Thus, employers and managers should try to identify and understand the needs of each individual worker and adapt, as much as possible, their practices accordingly.

That being said, and since the era that followed the COVID-19 pandemic has not yet received significant coverage in the literature, this dissertation aims to fill that void, taking into account all the aforementioned findings and, particularly, Ana Almeida's dissertation thesis (Almeida [2022]).

2.7 Literature Review Limitations

This literature review has some mentionable limitations. To begin with, a large portion of the studies selected focused on the forced adoption of remote work caused by COVID-19. The pandemic was an exceptionally distinct period that, despite the challenges it imposed, presented an excellent opportunity to study the phenomenon of remote work since virtually every team inevitably implemented it. However, due to the simultaneous lockdown, most of the experiences mentioned by the participants may have been contaminated by the necessity to stay at home and avoid social interactions at all costs, rather than by remote work itself. Secondly, many teams experienced working with multiple members outside the office for the first time during the early months of 2020. Therefore, several studies often only describe the first months following the transition to teleworking. However, as mentioned previously, teams were able to adapt their practices over time, allowing them to increase productivity and job satisfaction as the months went by.

Article	Sample[a]	Methodology	Goal
Sikes et al. [2011]	-	Literature study	Explore the advantages and challenges of telecommuting for IT managers and workers
Johri [2011]	42	Interviews and observations in Ireland and the USA	Study how globally spread software developers were able to overcome coordination challenges
Weinert et al. [2014]	57	Survey to analyze the factors causing stress	Study the increase in stress on IT professionals due to teleworking
Kaduk et al. [2019]	758	Survey-based research	Investigate the contrasts between voluntary and involuntary implementation of telecommuting and flexible schedules
Conradie and de Klerk [2019]	260	Survey-based research	Study the adoption of flexible work arrangements by developers in South Africa
Bezerra et al. [2020]	58	Survey-based research	Study the effect of human and organizational characteristics on productivity while teleworking
Neumann et al. [2021]	-	Interviews, observation and documentation analysis were conducted	Investigate how the pandemic and remote work have affected agile software development teams in Germany
Garro-Abarca et al. [2021]	317	Quantitative causal study using partial least squares	Study the factors that influenced performance while working as virtual teams
Russo et al. [2021]	192	Two-wave longitudinal study to select the predicting factors and test causal relations	Investigate the factors predicting well-being and productivity while working remotely
Das et al. [2021]	36	Reflexive thematic analysis of data gathered through interviews	Study the work-from-home practices of neurodivergent professionals
Wang et al. [2021]	475	A survey and interviews were conducted with workers from a Chinese technology company	Investigate whether and why the employees choose to work remotely or in office
Ford et al. [2021]	3634	Two surveys, distributed weeks apart, gathering qualitative and quantitative responses	Study the effects of working from home on productivity
Rodeghero et al. [2021]	267	Open-coding approach to analyze data gathered from an online survey	Analyze the remote onboarding process of new hires at Microsoft
Butler and Jaffe [2021]	435	Nightly diary study at Microsoft	Learn more about the employees' experience while working remotely
Miller et al. [2021]	2873	Two surveys, distributed weeks apart, gathering respectively qualitative and quantitative responses. Additionally, a regression model using the data from the second survey	Study the effects of working from home on productivity and team culture
Schmidtner et al. [2022]	171	Survey-based research	Study the effects of the pandemic and remote work on German agile software development teams
Topp et al. [2022]	7[b]	Interviews, project analysis, and observation	Examine the impact of remote work and a 4-day work week on software development teams
Bao et al. [2022]	139	Quantitative analysis based on a dataset of developers' daily activities from Baidu Inc	Compare the productivity when working from home or on the worksite
Smite et al. [2022]	1187	Analyses of several surveys and interviews with representatives from the companies	Study the changes in perceived productivity while working in office or remotely
Almeida [2022]	176	Survey-based research	Analyze the impact of remote work on Portuguese software professionals during the pandemic
Gibbs et al. [2023]	10000+	Analysis based on data from tools that monitored the workforce	Investigate the effects of the remote working period caused by the pandemic on productivity in an Indian IT services company

Table 1: Sample size, methodologies and goals

[a] The sample size, excluding some exceptions, is derived from the number of workers who participated in the surveys and whose responses were validated.
[b] Refers only to interviews.
Pre-pandemic period articles.
Pandemic and post-pandemic period articles.

Article	Advantages for Developers	Disadvantages for Developers
Sikes et al. [2011]	• Flexible work schedules • Decrease in interruptions • Improved work-life balance	• Challenging work-life balance
Johri [2011]	• Improved work-life balance • Possibility to move anywhere • Avoiding commute	
Weinert et al. [2014]		• Work overload • Challenging work-life balance • Lack of communication • Lack of socialization
Kaduk et al. [2019]	• Avoid work-family conflicts (voluntary remote)	
Conradie and de Klerk [2019]	• Increase in engagement	
Bezerra et al. [2020]		• Trouble avoiding distractions • To much meetings • Anxiety • Laziness • Challenging to have an appropriate work environment
Neumann et al. [2021]	• Increased transparency • More efficient meetings • Decrease in interruptions	• Lack of socialization
Garro-Abarca et al. [2021]	• Avoiding commute • Strength in cohesion	• Challenging communication • Challenging to maintain cohesion
Russo et al. [2021]		• Challenging for introverts
Das et al. [2021]	• Less distractions • Avoid the feeling of being watched • Flexible work schedules	• Challenging having a proper • workspace • Easy to be distracted in meetings • Too much meetings • Overworking • Lack of in-person communication
Wang et al. [2021]	• Avoiding commute • More time with family • Less interruptions	• Lack of office energy • Lack of physical interactions
Ford et al. [2021]	• More time with family • Sleeping more • Flexible work schedules • Less distractions • Less meetings • More personal workspace • Wear comfortable clothing • Spending less money • Avoiding commute	• Lack of socialization • Challenging work-life balance • Inappropriate ergonomics • Challenging to follow colleagues work • Doing less physical activities • Lack of motivation • Having children at home • Increase distractions • Less time to do tasks • Lack of a routine
Rodeghero et al. [2021]		• Lack of communication • Disconnection with colleagues • Uncomfortable to ask for help
Butler and Jaffe [2021]	• More time with family • Avoiding commute • More supportive teams • Better management	• Challenging work-life balance • Too much meetings • Inadequate work space • Lack of motivation • Lack of collaboration • Mental Health Challenges • Physical Pain • Overworking

Miller et al. [2021]		• Lack of socialization • Lack of quality communication • Lack of visual clues • Challenges to brainstorm • Challenging to follow colleagues work
Schmidtner et al. [2022]	• Agility of projects increased • Increase in flexibility • Flexible work schedules	
Topp et al. [2022]	• More efficient meetings • Shorter meetings • More quiet work environment • Less interruptions • Increase in motivation • Increase in job satisfaction • Avoiding commute • Flexible work schedules	• Lack of socialization
Smite et al. [2022]	• Decrease in stress • Decrease in interruptions • Avoiding commute • More efficient meetings • Better work-life balance • Flexible work schedules • More personal workspace	• Inappropriate ergonomics • Increase in stress • Increase distractions • Poor connectivity • Mismatched working hours with colleagues • Lack of optimum communication • Isolation • Lack of office energy • Work overload • To much meetings • Lack of socialization • Challenging work-life balance
Gibbs et al. [2023]		• Increase in working hours • Less uninterrupted work time • Decrease in networking

Table 2: Advantages and disadvantages for developers

Article	Advantages for the employers	Disadvantages for the employers
Sikes et al. [2011]	• Reduction in office space costs • Higher employee motivation due to more flexibility • Becoming more eco-friendly	• Tracking employee work may be harder • More vulnerable to cyber attacks • Teleworking may make employees feel less likely to be promoted • Need for resources such as VPNs and high-speed internet connection
Johri [2011]	• Lower turnover rate	
Conradie and de Klerk [2019]	• Increased performance • Increased engagement • Reduction in office space costs • Expanding the recruitment pool	
Neumann et al. [2021]	• Easier to integrate stakeholders in the development process • The process became more transparent • More efficient meetings	• Socially disconnected teams
Miller et al. [2021]		• Socially disconnected teams
Schmidtner et al. [2022]	• Expanding the recruitment pool	
Topp et al. [2022]	• More efficient meetings	

Table 3: Advantages and disadvantages for the employers

Article	Recommendations
Sikes et al. [2011]	• Managers should keep track of the work done • Having similar expectations for remote and non remote workers • Managers should frequently communicate with workers • Managers should schedule in-person meetings • Foster communication between workers
Weinert et al. [2014]	• Provide training sessions to reduce stress
Bezerra et al. [2020]	• Financial aid for home office upgrades • Having less meetings • Providing mental health support
Garro-Abarca et al. [2021]	• Trust must be prioritize
Russo et al. [2021]	• Provide training sessions to reduce stress • Having more flexible schedules • Defining daily routines • Scheduling informal meetings during working hours • Ensure the most introverts are involved • Ensure enough hours of sleep • Financial aid for home office upgrades
Das et al. [2021]	• Adapting practices to the needs of each worker • Sending agendas before meetings • Sending reports after meetings • Everyone should use their camera when in meetings • Ensure time to rest between meetings • Ensure everyone is able to talk in meetings • Integrate access technologies
Ford et al. [2021]	• Providing better hardware • Financial aid for home office upgrades • Having less meetings • Improve the communication tools
Rodeghero et al. [2021]	• Encourage new hires to ask for help • Everyone should use their camera when in meetings • Managers should schedule 1:1 meetings • Managers should help new hires to know the organization • Schedule team building activities • New hires should have a onboarding buddy • New hires should have a technical mentor • The process should match new hires' pace • Documentation should be accessible and up to date
Miller et al. [2021]	• Include socialization time in each meeting • Schedule team building activities within working hours • Ensure everyone is able to talk in meetings • Managers should schedule 1:1 meetings • 1:1 meetings between developers • Having communication guides (e.g., time for responses)
Schmidtner et al. [2022]	• Schedule team building activities • Schedule brainstorm sessions
Topp et al. [2022]	• Implement on-site events to promote socialization
Smite et al. [2022]	• Adjusting work policies for individual needs • Financial aid for home office upgrades • Foster collaboration

Table 4: Recommendations

Article	Findings
Sikes et al. [2011]	• Managers should have similar relationships and approaches with both remote and onsite workers
Johri [2011]	• In order to achieve work-life balance while collaborating with global teams, the developers adopted new strategies to communicate proposed by themselves
Weinert et al. [2014]	• A significant portion of the stress experienced by individuals working remotely was attributed to factors such as excessive workload, disrupted work-life balance, communication breakdowns, and social isolation • Work overload was the primary source of exhaustion • Only the lack of social interaction and exhaustion showed a statistically significant impact on the desire to quit teleworking • Organizations should monitor their remote workforce
Kaduk et al. [2019]	• It is common for employers to allow their employees to work remotely • Working remotely can improve the overall well-being • Employees who opted for remote work were more successful in avoiding work-family conflicts • Employees forced to work remotely, faced more work-family conflicts than those working on site
Conradie and de Klerk [2019]	• There was no significant difference in working hours or tenure between workers who adopted remote work and flexible work hours and those who did not • The adoption of remote work and flexible work hours can benefit both employees and organizations
Bezerra et al. [2020]	• Experience had a positive impact on performance • More than half of the developers did not changed their work routine when working remotely • However, some workers did had to change their routine, due to work overload, domestic tasks or psychological challenges • The vast majority of those inquired rated the communication as good or excellent and were able to stay motivated • Most of the workers reported being able to maintain good or excellent productivity
Neumann et al. [2021]	• The remote working had no negative effects on productivity, having increased it in some cases • The development process became more transparent, efficient and stakeholders became more integrated • Adjustments to the agile practices were conducted, such as digitization of artifacts • Communication has become more efficient • Socialization between colleagues decreased • An increase in conflicts was not noticed
Garro-Abarca et al. [2021]	• A significant portion of the developers surveyed reported they plan to work fully or partially remotely in the post-pandemic period • Trust was the factor that had the strongest influence on performance
Russo et al. [2021]	• Well-being and productivity are positively correlated • Excessive pressure on developers is not a productive strategy • Maintaining productivity enhances well-being • Strategies should be adjusted to the individual needs of each developer
Das et al. [2021]	• Neurodivergent developers have different needs • Practices should be adapted to the individual needs of each developer
Wang et al. [2021]	• During the forced remote period, productivity did not decrease for the vast majority of the developers, having increased in many cases • When it was again possible to work in the office, an hybrid mode was chosen by a major part of the developers • A significant percentage of the developers tried to synchronize their days in office with colleagues • In regards to productivity, the hybrid mode had positives effects or no effects for the vast majority of the developers

Ford et al. [2021]	• Some developers had opposing experiences regarding some of the factors (e.g., The frequency of meetings was adequate for some, but excessive for others) • The number of pull request remained similar • Remote work had little to no impact on productivity
Rodeghero et al. [2021]	• Despite several challenges, a large percentage of developers reported feeling connected with their team • New hires struggled to communicate with colleagues, seeking help, browse documentation, and to connect with teammates
Butler and Jaffe [2021]	• Compared to engineers, managers reported having to deal with more challenges, such as experiencing an excessive workload • Having inadequate work-spaces and connectivity were frequent among engineers
Miller et al. [2021]	• The team culture remained unchanged for most developers, however the lack of socialization was challenging • Quality communication was challenging
Schmidtner et al. [2022]	• The projects agility and flexibility increased, during the forced remote work period • While working remotely, the productivity decrease slightly • More than half of the participants inquired expect the percentage of developers working remotely after the pandemic to increase
Topp et al. [2022]	• While working remotely and adopting a 4-day work week, the duration of each agile sprint was shortened • The switch to remote made meetings more coordinated and shorter • The vast majority of the developers was able to maintain or increase productivity, due to the quiet environment with less interruptions • The switch had positive effects on well-being • The relationships with colleagues did not change or have slightly deteriorated
Bao et al. [2022]	• Less number of compilations and lines inserted when remotely • Remote and onsite developers had similar success rate of build • Success rate of release was higher when onsite • Remote and onsite developers had similar productivity
Smite et al. [2022]	• Following the switch to remote, while productivity has decrease for some teams, it has increased for others • As the weeks of remote work progressed, productivity improved • Developers were able to adapt to remote work and stay productive
Almeida [2022]	• Participants who worked remotely prior to the pandemic used teleconference technologies with a similar frequency throughout the COVID-19 crisis • Not feeling safe coming back to the on-site arrangement after the pandemic, typically meant a preference for working exclusively remotely. Otherwise, the hybrid regimen was the most favored • Having dependants may have a negative effect on individuals' work and prompt them to prefer spending more days at the office
Gibbs et al. [2023]	• The productivity decreased when working remotely • However, the output remained similar • Employees with children had to work more hours • Smaller teams were able to maintain similar productivity • Due to an increased frequency of meetings, struggle to maintain focus and decrease in direct communication, the developers started working more hours to fulfill deadlines

Table 5: Findings

Part II

Core of the Dissertation

Chapter 3

Methodology

In this chapter, the methodology employed is discussed, providing an in-depth analysis of the selected data collection instrument, the target population, the sampling techniques, and the data collected. Furthermore, the research questions to be addressed are presented.

3.1 Data Collection Instrument

A survey via a questionnaire was used to collect as many experiences as possible from the members of the software development teams and, consequently, evaluate the remote work adoption after the COVID-19 pandemic.

Conducting the survey involved several steps, from defining the objectives to analyzing the data and drawing conclusions. The tasks depicted in Figure 2 were carried out during the first stage:

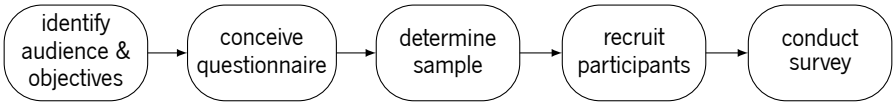

Figure 2: Main steps of the process to apply a survey, based on Fernandes and Machado [2016]

Target Population and Sampling Methods

As mentioned before, the target population for the questionnaires was members of Portuguese software development teams.

Therefore, participants were not required to be programmers themselves. They only needed to be a part of a software development team based in Portugal to be included among the legitimate participants.

Due to the voluntary nature of the survey, the absence of contacts for every member of Portuguese software development teams, and in order to reduce costs related to time, the sampling followed a non-probability procedure, namely convenience sampling (according to Battaglia and Lavrakas [2008]). To

reach the population, representatives from software development companies, such as human resources teams, team managers, and CEOs, were contacted by e-mail or LinkedIn and kindly asked to forward the questionnaire to the organization members. Following this approach, it was possible to collect more responses and ensure the participants' legitimacy, at the expense of introducing bias due to the lack of randomness in the sample selection.

Questions

The following questions must be addressed using the information collected through the questionnaires:

- **RQ1: How prevalent is remote work in the period following the COVID-19 pandemic?**
  - Q1: Which work regimen is most commonly adopted by the software development team members?
  - Q2: What are the preferred work arrangements and, consequently, office attendance frequencies among the software development team members?
  - Q3: Are employers giving flexibility to adopt remote work?
  - Q4: How did the participants' work regimen change between the pre-pandemic and the post-pandemic periods?
  - Q5: To what extent would individuals prioritize a job offer that aligns with their preferred work regimen over a job offer that does not, considering similar conditions?
  - Q6: Is there a relationship between the years of experience and the current work regimen?
- **What are the benefits and downsides associated with remote working from the perspective of the software developers? (RQ2)**
  - Q7: What are the main factors that justify individuals' preferences for particular work regimens?
  - Q8: Do participants perceive a difference in productivity between remote and on-site work?
  - Q9: Does the participants' preferred work regimen favor the environment where they feel more productive?
  - Q10: Does the belief that remote workers are being inadequately integrated influence individuals' work regimen preferences?

- **How can remote work be more productive? (RQ3)**
  - Q11: Which are the most commonly used strategies to stay productive while working remotely? Do they vary according to the work regimen?
  - Q12: Are the employers assisting their remote workers in building adequate workspaces?
- **What challenges do the coexistence of remote and in-office work imposes? (RQ4)**
  - Q13: Has the existence of remote workers impacted team dynamics and collaboration?
  - Q14: What is the overall perception of remote workers' integration into team dynamics?
  - Q15: To what extent do workers believe that promoting team-building activities or informal conversations would foster team spirit, particularly among remote workers?
  - Q16: How do employees perceive the effect of remote work on productivity hindrances caused by meetings or delays in addressing simple questions that could be resolved quickly in an office mode?
  - Q17: Do the remote employees believe they have the same opportunities to be promoted as their coworkers who attend the office?
  - Q18: Is there a relationship between the work environment where participants feel more productive and their assessments of the effects of remote work on communication?
- **How can the synergy between remote and in-office work be enhanced? (RQ5)**
  - Q19: Which strategies have teams implemented to optimize the adoption of remote working?

Questionnaire Structure

The following sections were used to, not only directly respond to the 19 questions, but also to determine whether the participants' demographic characteristics and academic and professional backgrounds affected their perceptions of remote work:

1. Demographic Data: used to characterize the gender, age group and birth country of each participant. An additional question was included to verify if the inclusion criteria were met.
2. Academic and Professional Data: used to characterize the academic background, years of experience in the industry, and current job position and company of each participant.

3. Work Arrangements: to document the participants' current work regimen/arrangement, the regimens adopted prior to and after the pandemic period, and the flexibility provided by their employer.

4. Productivity:

    - Productivity in hybrid arrangement: only for participants who work in a hybrid regimen. Used to assess how participants' levels of perceived productivity differ when working in-office and remotely, which strategies are adopted by them to increase productivity when working remotely, to determine if they have an adequate workspace at home, and, lastly, to quantify the extra hours they are required to put in when working in-office and remotely.
    - Productivity in remote arrangement: exclusively for participants who work in a remote regimen. Used to determine how participants' perceptions of their productivity vary when working in-office (if applicable) and remotely, the strategies they often use to be more productive while working remotely, to assess if they think their workspace at home is suitable, to determine how many extra hours per day are they forced to work and to evaluate if they feel they have the same opportunities to be promoted as their colleagues who work in-office.
    - Productivity in in-office arrangement: exclusively for those working in an in-office regimen. Used to determine how participants' perceptions of their productivity vary when working in in-office and remotely (if applicable), if they have ever worked remotely, what methods they frequently employ to be more productive, to determine how many extra hours per day are they required to work, and lastly to assess if they feel team spirit would be strengthened if their whole team worked in-office.

5. Improvements: to assess if the participants feel that the existence of remote workers has any impact on the dynamics and collaboration between team members, if they believe that remote workers are well-integrated into the team dynamics, if they think their employer should promote more team-building events to foster team spirit, if they feel that productivity is hindered due to prolonged waits for responses that should be answered quickly in an office setting, which strategies were utilized by their team to improve the remote work adoption as well as any additional suggestions they had, and, lastly, which was their preferred working regimen.

6. Preferred Arrangement:

    - On-site Arrangement: exclusively for participants who favor an on-site regimen. Intended to determine the main factors that justify their preference for the on-site regimen and to find out

if the participants would prioritize a job offer that allowed for in-office work.

- Hybrid Arrangement: exclusively for participants who favor a hybrid regimen. Intended to determine the main factors that justify their preference for the hybrid regimen and to find out if the participants would prioritize a job offer that allowed for remote work.
- Remote Arrangement: exclusively for participants who favor a remote regimen. Intended to determine the main factors that justify their preference for the remote regimen and to find out if the participants would prioritize a job offer that allowed for remote work.

Dataset

	Answers	**Valid Answers**
Portuguese version	187	163
English version	12	12
Total	199	175

Table 6: Dataset overview

The questionnaire was initially distributed among a network of close contacts in order to detect any potential mistakes and identify ways to improve it. Seven responses were submitted throughout this first phase, which ran from March 20 to March 27, 2023. Even though the questionnaire underwent a few adjustments, they only included rearranging the questions. Hence, the responses already collected could still be used.

Once fully refined, the final distribution stage was conducted practically until June 19, 2023, at which point, it was decided to stop accepting new participants as the rate of new responses was practically non-existent. In total, 199 submissions were collected, but only 175 were considered valid as they claimed to be part of a software development team.

It is essential to note that the questionnaire was made available in both English and Portuguese to obtain more responses and because anyone who works on a Portuguese software development team, regardless of their nationality, could participate. A Python script was used to translate the data to English, as well as to perform some of the subsequent statistical analysis.

Age Group (years)				
18-25	26-35	36-50	51-65	65+
44	78	49	4	0

Table 7: Frequency of participants' age group

Gender			
Female	Male	Other	I prefer not to say
46	126	0	3

Table 8: Frequency of participants' gender

Birth Country										
Portugal	Brazil	France	Angola	Germany	Iran	Macau	Moldova	Ukraine	United Kingdom	Venezuela
151	14	2	1	1	1	1	1	1	1	1

Table 9: Frequency of participants' birth country

Academic Background						
Masters	Bachelor's degree	High School	Post-graduation	PhD	CTeSP*	Professional Course
78	75	10	4	3	3	2

*Higher professional technical programmes (cursos técnicos superiores profissionais - CTeSP).

Table 10: Frequency of participants' academic background

Experience in the software development industry (years)					
Less than a year	[1-2[	[2-5[	[5-10[	[10-20[	20+
21	24	51	35	28	16

Table 11: Frequency of participants' experience in the industry

Job Position		**Job Position**	
Back-End Developer	32	Mobile and Frontend Developer + Engineering Manager	1
Business Analyst	5	Operations	1
Chief Executive Officer (CEO)	2	OutSystems Developer	1
Chief Innovation Officer	1	Product Manager	5
Data Engineer	3	Product Owner	3
Data Scientist	8	Project Manager	11
Delivery Manager	1	Salesforce Developer	1
DevOps Engineer	4	Security Architect	1
DevOps Manager	1	Scrum Master	3
Dynamics 365 Consultant	1	Software Developer	3
Front-End Developer	16	Support Engineer	1
Full-Stack Developer	40	System Administrator	3
Group Lead	1	Technical Manager	1
Head of Operations	1	Team Leader	2
HR Manager	1	Technical Leader	1
Machine Learning Engineer	1	Test Engineer	12
Mobile Developer	1	UI/UX Designer	4

Table 12: Frequency of participants' job positions

Chapter 4

Statistical Analysis and Results

4.1 Statistical Analysis

The statistical analysis relating to each of the 19 questions can be classified into three methodologies depending on the nature of the data:

- Qualitative analysis: Q7, Q19;
- Quantitative analysis:
  - using only the percentages: Q1, Q2, Q3, Q4, Q5, Q11, Q17;
  - using the percentages, median and mode: Q8, Q9, Q12, Q13, Q14, Q15, Q16;
  - using an association test: Q6, Q10, Q18.

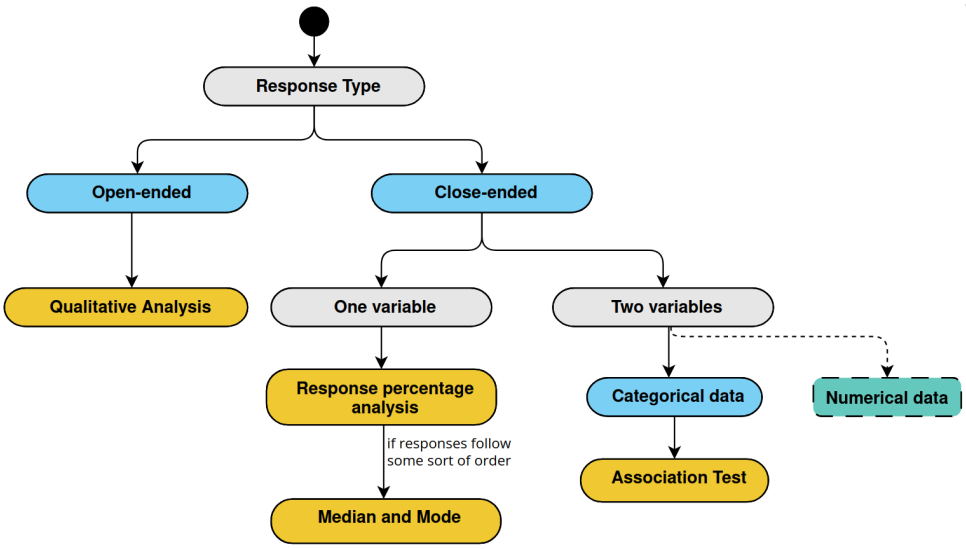

Figure 3: Statistical analysis methodology

Qualitative analysis was used to examine indicators involving open-ended replies, i.e., asking participants to submit some written sentences or paragraphs.

The questionnaire was, however, mainly composed of questions with closed answers, meaning that the possible responses were given from a group of options. For those, different quantitative analysis approaches were employed, depending on the number of indicators in study. When only one was being examined, the percentage of each response was utilized, as well as the mode and median when the responses followed some sort of order. Meanwhile, when analyzing the relation between two indicators, and since every variable in the study was categorical, either the Pearson's (χ^2) test or the Fisher-Freeman-Halton exact test was used.

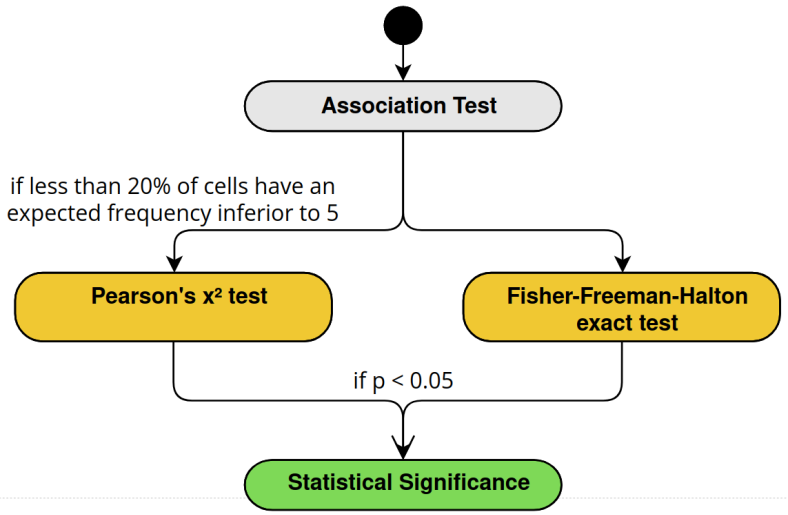

Figure 4: Association Test

As illustrated in Figure 4, this statistical hypothesis test can follow two forms depending on the percentage of cells that have an expected frequency inferior to 5:

- if said percentage is less than 20%, the Pearson's (χ^2) test should be used;
- if the percentage is equal or superior to 20%, then the Fisher-Freeman-Halton exact test should be employed instead. [1]

It was decided to use a 95% confidence interval. Therefore, the test proved to be statically significant, meaning there exists a relation between the two variables, if the p-value is inferior to 0.05.

If proven statistical significance, the way to measure the effect size of such a relation depends on the number of categories in each variable, as stated by Akoglu [2018]. If both variables were only composed

[1] As instructed by Ozturk et al. [2023], the Fisher-Freeman-Halton exact test was employed instead of the standard Fisher exact test, since none of the questions were defined by a 2x2 contingency table

of two categories each, then the value of ϕ should be used. However, ϕ_c must be utilized if one or more variables include more than two categories. Figure 5 describes the process to determine the effect size.

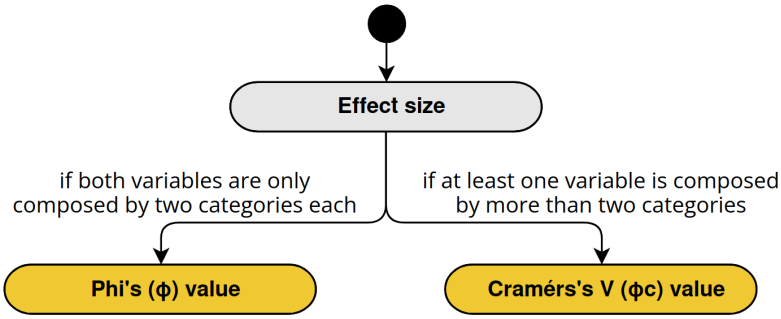

Figure 5: Effect size

The median and mode were computed using a Python script, and both the Pearson's (χ^2) test and the Fisher-Freeman-Halton exact test were performed using SPSS Statistics for Windows.

It is, however, crucial to notice the association test was also employed in several questions initially meant to assess just one variable (e.g., Q13, Q14, Q15 and Q16). This additional test was conducted to ascertain the existence of a relation between the indicators under analysis and the participants' current work regimens.

It is also noteworthy that, due to the rounding of values in several questions' graphs and tables, the sum of the percentages does not always equate to exactly 100% (i.e., they can be 99.9% or 100.1%).

4.2 Results

4.2.1 Q1: Which work regimen is most commonly adopted by the software development team members?

Asked to identify their current work arrangement, participants responded as depicted in Figure 6.

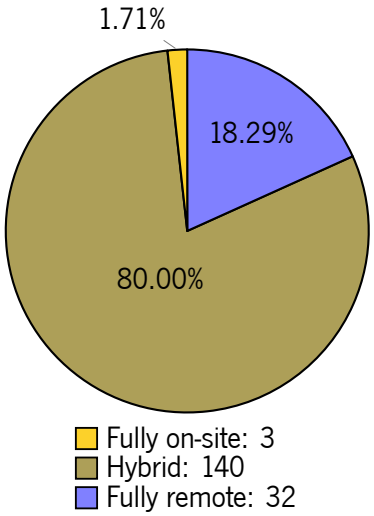

Figure 6: Q1 responses distribution

The software development team members are predominantly adopting a hybrid work regimen (80%). Subsequently, a significant portion works in a fully remote work arrangement, while those who work exclusively on-site have a much lower representation.

These results highlight the remote-oriented work arrangements popularity, indicating, however, that a substantial portion of the participants continue to come into the office every week. That may suggest that, despite the growing acceptance of teleworking, either organizations still feel the need to require their employees to come into the office, or the workers themselves may acknowledge the need to maintain in-person contact with their colleagues.

4.2.2 Q2: What are the preferred work arrangements and, consequently, office attendance frequencies among the software development team members?

The answer distribution show in Figure 7 was compiled when asking respondents to name their favorite work arrangement.

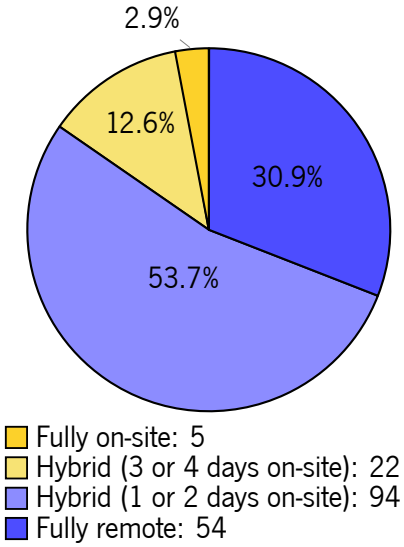

Figure 7: Q2 responses distribution

It is evident that the hybrid regimen with only one or two days per week spent in the office emerges as the favorite among the participants. A sizeable portion of respondents prefers the entirely remote arrangement, while the hybrid regimen that includes three to four days of in-office work is prioritized by only 12.6%. Lastly, a marginal percentage of the participants claim they would like to embrace a fully in-office arrangement.

These results suggest that working exclusively from the office may not align with the preferences of most software development team members, emphasizing the popularity of working from home either daily or, at least, a few days a week. It is clear, however, that occasionally attending the office is still highly valued.

4.2.3 Q3: Are employers giving flexibility to adopt remote work?

When asking participants to identify all the work arrangements their employer allows them to embrace, they submitted the answers summarised in Figure 8.

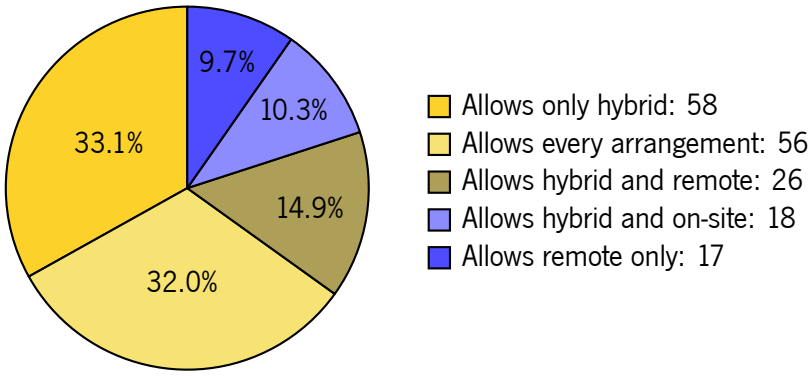

Figure 8: Q3 responses distribution

More than a third of the participants reported their employer only lets them work in a hybrid arrangement, while a similar percentage claimed they can select any work regimen. Moreover, a considerable fraction (14.9%) indicated they can choose either to work remotely or in a hybrid regimen, whereas just over 10% are also able to work in a hybrid model but, in contrast, just have the alternative to work fully on-site. A nearly equivalent percentage claimed they only have teleworking available to them.

These findings highlight the popularity of the hybrid schedule since nearly 91% of the participants claimed their employer allows them to work in such an arrangement. Additionally, the substantial percentage of participants only able to work on a hybrid regimen indicates that employers recognize the value of enjoying both the advantages of working remotely and attending the office every week. Furthermore, observing that only 42.3% of the employees are able to work exclusively in-office and that no participants reported being forced to attend the office daily, it is conceivable to suggest a diminishing interest in having the employees strictly in an in-person working environment.

However, it is crucial to acknowledge that several respondents share the same employer, meaning that the reports do not pertain to distinct corporations. Additionally, numerous individuals sharing the same employer reported being granted distinct work regimens' flexibility, perhaps because employees have different roles and responsibilities even if they are part of the same corporation.

4.2.4 Q4: How did the participants' work regimen change between the pre-pandemic and the post-pandemic periods?

The responses in Figure 9 were collected when asking participants to list every arrangement in which they had worked both before and after the pandemic.

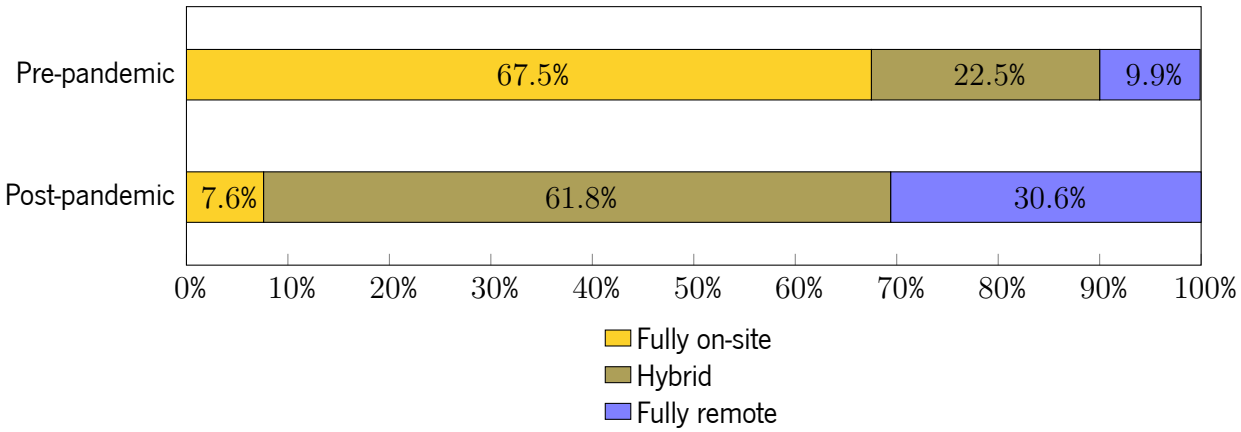

Figure 9: Comparison of Pre-pandemic and Post-pandemic Work Regimens

In the pre-pandemic period, the fully on-site regimen was by far the most popular among the software development team members, followed by the hybrid arrangement, and the fully remote one being the least frequent. However, after the COVID-19 pandemic, the most predominately adopted regimen is the hybrid one, followed by the fully remote one. Previously the most popular, the exclusively on-site arrangement became the least frequently embraced.

Some other interesting facts can be observed:

- among the 84 participants who worked exclusively on-site prior to the pandemic, 82 of those have experienced the hybrid or fully remote arrangements afterward;
- only 2 out of the 84 participants who worked exclusively on-site prior to the pandemic, remain exclusively committed to that regimen after it;
- among the same 84 participants who only worked on-site before the pandemic, only 12 at some point went back to working in an on-site arrangement;
- only 1 out of the 27 participants who had only worked remotely or in a hybrid regimen before the pandemic reported having worked on-site for the first time afterward.

The results indicate that the COVID-19 pandemic had a profound influence on the work preferences of software development professionals. The lockdowns and consequent requirements for working from

home measures likely forced both the teams and the employees to adapt to teleworking and, consequently, recognize its benefits, accelerating the shift to more remote-oriented arrangements.

4.2.5 Q5: To what extent would individuals prioritize a job offer that aligns with their preferred work regimen over a job offer that does not, considering similar conditions?

When asked if, in a scenario where they were looking for new challenges and had in their hands two job offers with similar conditions, one enabling their preferred work arrangement and the other not, they would prioritize the first one, the participants responded as illustrated in Figure 10.

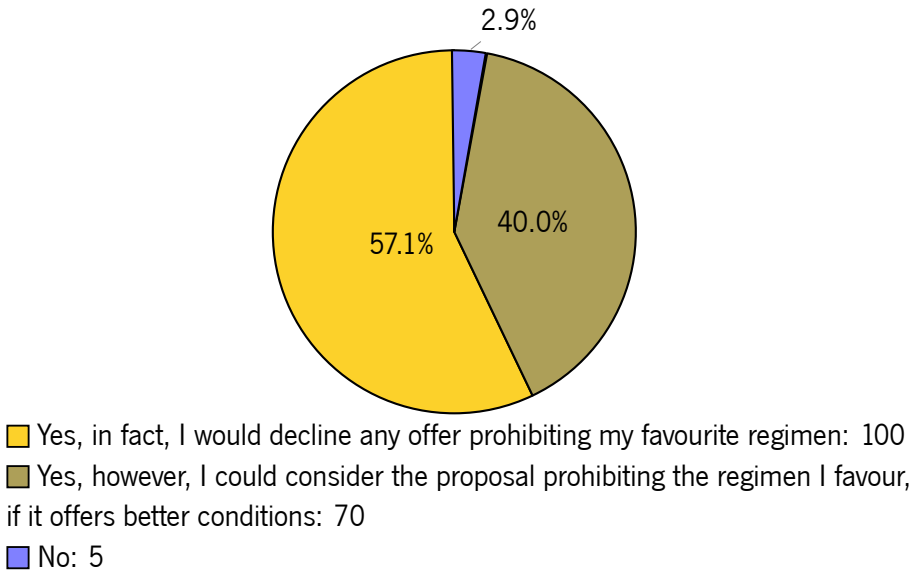

Figure 10: Q5 responses distribution

One can conclude that the majority made it clear they would reject any proposal that would not allow them to embrace the work regimen they prefer, even if it includes improved terms. Furthermore, a significant percentage of them mentioned that, although they give precedence to a proposal aligned with their preferences, they might be willing to accept one that limits that desire if it presents more advantageous terms.

When examining the data divided by regimen preferences in Figure 11, we can see that those who prefer an exclusively remote arrangement are more likely to object to any proposal prohibiting teleworking. It is noteworthy, however, that somewhat contradictory results are evident since 20% are not disturbed by a potential requirement to attend the office. Meanwhile, and despite the limited participation, those favoring an in-office regimen expressed a similar intention to prioritize their arrangement preferences.

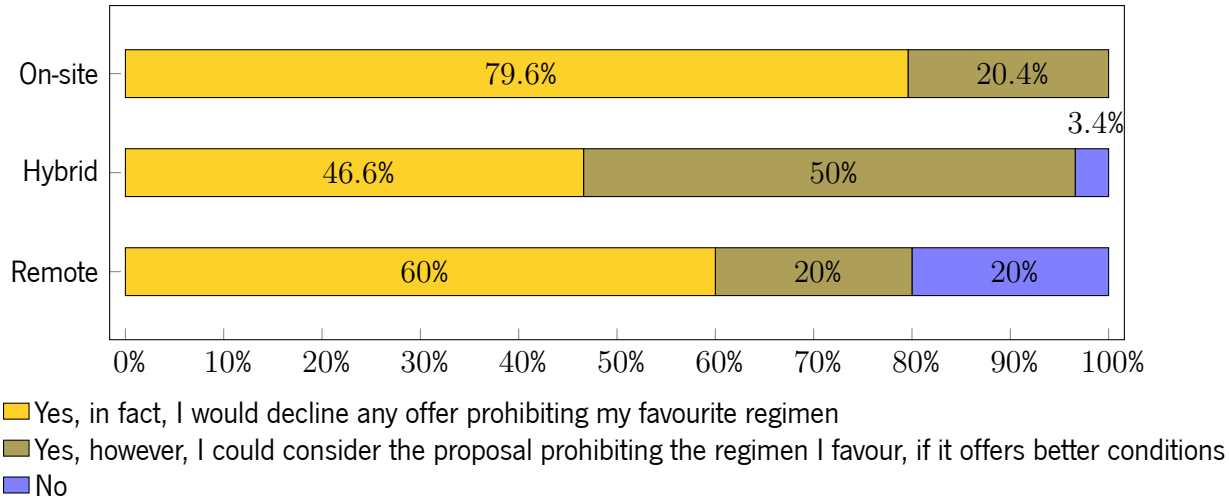

Figure 11: Q5 responses distribution divided by favourite regimen

As expected, these findings denote that those who aspire to work remotely daily are more likely to request the ability to embrace their favorite regimen than those who expressed a desire for a hybrid configuration. Moreover, this suggests that employees should be as flexible as possible in order to broaden their talent pool.

4.2.6 Q6: Is there a relationship between the years of experience and the current work regimen?

As the question suggests, the purpose was to determine whether there is a relation between the participants' years of experience in the field and their favorite work arrangement. Table 13 displays the cross-tabulated data, along with the Fisher-Freeman-Halton exact test results.

	Current work regimen				
	Fully on-site	Hybrid	Fully remotely		
Years of experience	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
Less than a year	0	20 (95.2%)	1 (4.8%)	21	**FFH exact test** p = 0.062 ϕ_c = 0.216 CI = 95%
1-2 years	0	19 (79.2%)	5 (20.8%)	24	
2-5 years	1 (2.0%)	36 (70.6%)	14 (27.5%)	51	
5-10 years	0	28 (80.0%)	7 (20.0%)	35	
10-20 years	2 (7.1%)	25 (89.3%)	1 (3.6%)	28	
20+ years	0	12 (75.0%)	4 (25.0%)	16	

Table 13: Q6 results overview

The Fisher-Freeman-Halton exact test yielded a p-value of 0.062, meaning that no statistical significance was proved, and therefore suggesting that no relation exists between the years of experience in the field and the desired work regimen. Despite that, some trends are observable in Figure 12. Among the participants with less than five years of experience, there is a noticeable trend toward remote working becoming more popular than the hybrid regimen as years in the field accumulate. The percentage of people who adopt a hybrid arrangement is, however, increasing in the age groups of 5 to 10 and 10 to 20, with the particularity that it is, once again, dramatically declining among those with more than 20 years of experience in the field. These trends could be explained by a greater need for less experienced workers to attend the office, justifying the 95.2 percent percentage of hybrid participants among those who have not yet completed a year of work in the area. However, over time, it is likely that both employers and employees themselves have come to believe they do not need this face-to-face interaction with the team. After five years of experience, the trend begins to reverse, which can be attributed to either the fact that these participants hold more leadership positions or that they spent a large portion of their careers mostly working in person in the past (during the pre-pandemic period) and, as a result, feel a greater need to commute to the office. However, and somewhat contradicting the previous theory, some professionals with over twenty years in the field seem to prioritize teleworking.

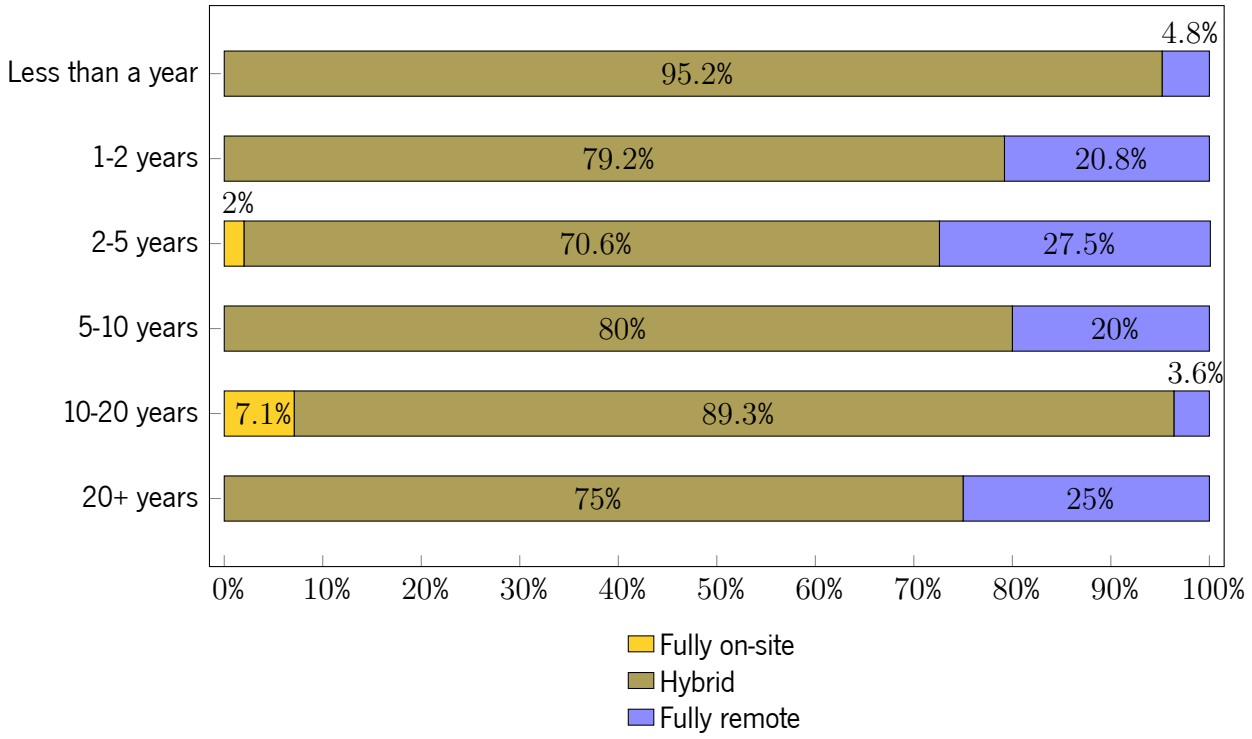

Figure 12: Q6 response distribution divided by favorite regimen

4.2.7 Q7: What are the main factors that justify individuals' preferences for particular work regimens?

When prompted to list the primary justifications for their work regimen preferences, participants shared the forthcoming motivations:

Those who prefer the remote regimen:

The main justification cited by the participants for preferring a remote work arrangement is avoiding the need to commute. This results in savings of both time and money and, for some, avoiding long traffic queues also means less fatigue and stress.

The time saved by avoiding commuting allows participants to have more free time outside of work, therefore having a healthier work-life balance. This means more time to spend with their family, enjoy leisure activities, do household chores, or deal with personal matters such as appointments.

The cost savings referenced above concerned not only travel-related expenses, but also the possibility of saving on food and not having to be housed in another city.

Increased productivity as a result of working from home was also one of the most frequently mentioned advantages. According to the participants, having a more comfortable and controlled environment with less noise, interruptions, and distractions allows them to be more focused and, therefore, more productive.

The possibility of benefiting from greater comfort was also reported, without explicitly mentioning productivity as a consequence. It was stated that having a more cozy and controlled environment, adjusted to each participant's individual needs and preferences, is only possible at home.

Other advantages listed were the possibility of having a healthier diet, flexible working hours, and the freedom to live anywhere.

Those who prefer the hybrid regimen:

Among the participants who preferred the hybrid regimen, the possibility of saving time and money on commuting was once again the most frequently referenced motive for their election. Some testimonials mentioned that one can save up to four hours per day by not having to commute to and from work, as well as economizing by avoiding eating out.

Once more, the time saved by avoiding traveling to and from the office results in a better work-life balance and allows many to benefit from greater comfort, a quieter environment, and the freedom to dress more casually.

As expected, a new justification has emerged compared to those who favor a fully teleworking arrangement: the ability to socialize with their colleagues. According to the respondents, such interaction enhances team spirit, forges close relationships with coworkers, improves communication, aids in getting to know new members, and ultimately builds a connection with the business.

One of the crucial points is also the opportunity to profit from more flexibility, namely benefiting from the convenience of working remotely from home or while traveling when needed, having more adaptable working hours, and a greater degree of freedom regarding work management.

An increase in productivity also influences the decision of many. On the one hand, the hybrid regimen enables greater focus and minimizes distractions while working from home. However, some participants claim that the arrangement's in-person component helps them improve communication with their colleagues, be aware of everything that is going on, as well as be more effective in tasks that depend more on human contact, thus boosting their productivity.

A few additional advantages listed are the ability to benefit from the office facilities, the potential to switch up routines between home and the office, and experiencing less stress.

In essence, the participants claim that the hybrid arrangement is the best of both worlds since it combines the advantages of working remotely and in-office.

Those who prefer the in-office regimen:

Despite the relatively low percentage of participants who favored the on-site regimen, its advantages are still recognizable. The most frequently mentioned benefit was undoubtedly the improved team spirit

and connection among coworkers, followed by enhanced concentration and productivity, more effective communication, quicker learning curves, sticking to a routine, and use of the office's facilities.

4.2.8 Q8: Do participants perceive a difference in productivity between remote and on-site work?

The participants' responses to the question regarding the work environment that maximized their productivity are depicted in Figure 13.

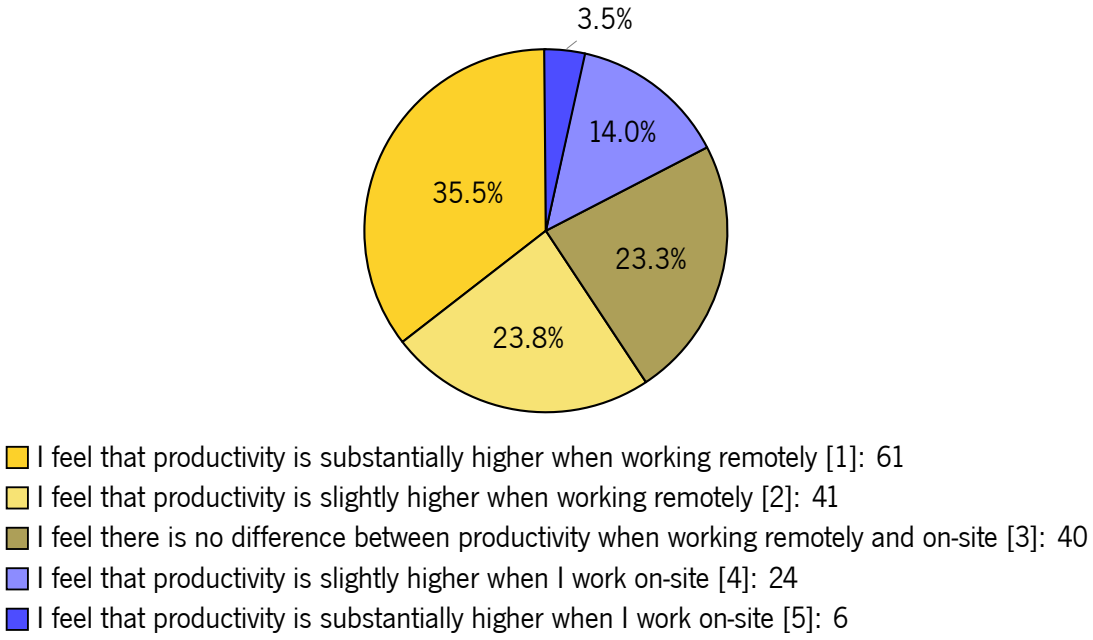

Figure 13: Q8 response distribution

Most participants claimed that when working remotely, their productivity increases, with 35.5% taking it a step further and reporting that teleworking allows them to be substantially more productive. Conversely, only a small percentage of 20% notice a decline in productivity while working offsite.

The median and mode of the responses were calculated by converting them using the Likert scale presented in the Figure 13 legend:

	Mode	Median
Q8	1	2.0

The results made it clear that working remotely can improve work efficiency. However, it is crucial to acknowledge that approximately one out of every seven participants (15%) should have access to in-office

work in order to maximize their productivity. Additionally, due to the work environment shifts inherent to the hybrid regimen, it should be investigated the occurrence of significant productivity fluctuations throughout the week by those embracing such an arrangement. This subject is covered in the following question.

4.2.9 Q9: Does the participants' preferred work regimen favor the environment where they feel more productive?

To assess whether there is a tendency for professionals to favor the regimen that maximizes their productivity, the Fisher-Freeman-Halton exact test was employed using the participants' answers to both questions. The results are given by Table 14.

	Preferred work regimen				
	Fully on-site	Hybrid	Fully remotely		
In which regimen do the participants feel more productive?	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
Substantially higher when on-site	3 (50.0%)	3 (50.0%)	0	6*	**FFH exact test** $p < 0.0001$ $\phi_c = 0.495$ CI = 95%
Slightly higher when on-site	1 (4.2%)	23 (95.8%)	0	24*	
No difference	1 (2.5%)	29 (72.5%)	10 (25.0%)	40*	
Slightly higher when remotely	0	33 (80.5%)	8 (19.5%)	41*	
Substantially higher when remotely	0	26 (42.6%)	35 (57.4%)	61*	

*The aggregate number of answers is 172, not 175, given some participants have never worked both in-office and remotely. Additionally, to enable SPSS to run the FFH test, the responses indicating a preference for the hybrid regimen were condensed.

Table 14: Q9 results overview

Due to the complexity of the replies and a lack of memory, the Fisher-Freeman-Halton exact test could not be employed with the four regimen options of the questionnaire. To overcome this issue, the two hybrid alternatives, used in the questionnaire to distinguish those who favor more working days in-office or have a stronger inclination towards working primarily remotely, were merged into one.

Despite that, the results displayed in Table 14 suggest the existence of a relation between the context in which participants feel more productive and their preferred work regimen. Therefore, it is possible to affirm that professionals take into account not only convenience, but also their perception of productivity when selecting their preferred work arrangement. The ϕ_c value of 0.495 indicates the relation is very strong, according to Akoglu [2018].

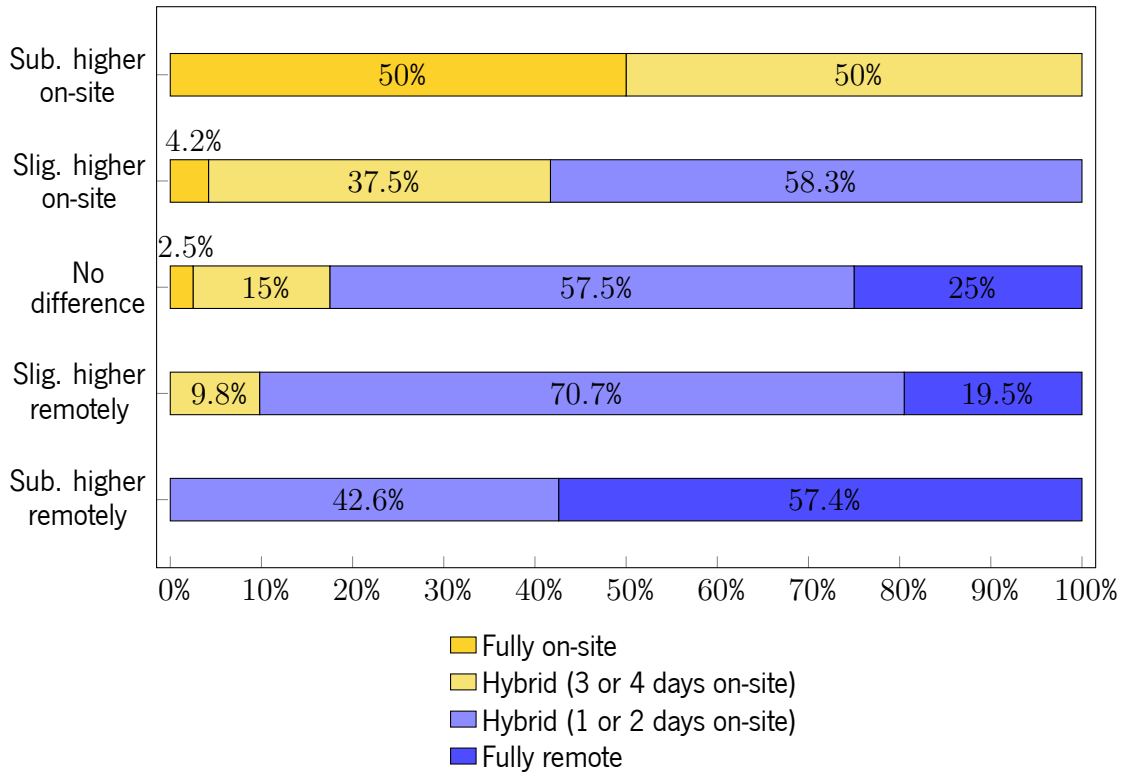

Figure 14: Q9 response distribution divided by perceptions regarding productivity

By analyzing Figure 14, it is possible to confirm that participants tend to favor the regimen that amplifies their effectiveness. It is crucial to acknowledge, however, that the majority of those who claim they are somewhat more productive when on-site still prefer to spend less than half of their workweek in the office. And a similar potential loss of productivity is observable among those who feel they are substantially more productive in the office, since half of them convey a desire to work part of the week remotely nonetheless. The same conflicting tendency is noticeable among individuals who are more productive when teleworking, although it appears less alarming.

4.2.10 Q10: Does the belief that remote workers are being inadequately integrated influence individuals' work regimen preferences?

In an effort to address such a question, a contingency table containing the responses regarding the integration of remote coworkers and the preferred work regimen is presented, as well as the results of the Fisher-Freeman-Halton exact test.

	Preferred work regimen					
	Fully on-site	Hybrid (3 or 4 days on-site)	Hybrid (1 or 2 days on-site)	Fully remotely		
Are remote workers adequately integrated?	n(%)	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
No, they're totally out of place	1 (100%)	0	0	0	1*	**FFH exact test** p = 0.003 ϕ_c = 0.304 CI = 95%
No, they're inadequately integrated	2 (14.3%)	3 (21.4%)	7 (50.0%)	2 (14.3%)	14*	
Yes, however they could been better integrated	2 (3.7%)	8 (14.8%)	31 (57.4%)	13 (24.1%)	54*	
Yes, they're always adequa-,tely integrated	0	11 (10.5%)	55 (52.4%)	39 (37.1%)	105*	

*The aggregate number of answers is 174, not 175, given some participants have never been part of a team composed of on-site and remote workers

Table 15: Q10 results overview

The findings in this question were statistically significant, demonstrating a relation between the perception regarding how effectively remote workers are being integrated and individuals' work arrangement preferences. Therefore, and by examining the results in SPSS, it is feasible to affirm that feeling like remote workers are adequately integrated results in a tendency to prefer teleworking, either daily or in a significant portion of the week, as one may confirm by observing Figure 15. Similarly, reporting a lack of adequate assimilation of remote workers often means a preference towards working more days on-site. The relation proved to be very strong, according to the ϕ_c value.

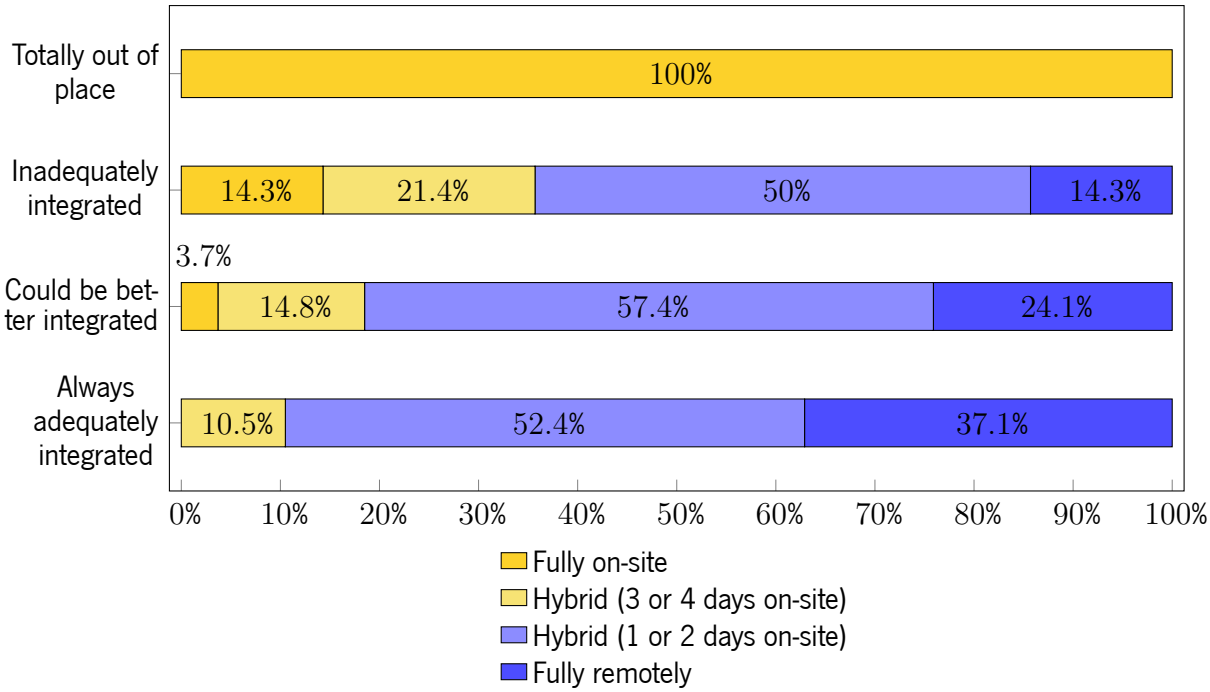

Figure 15: Q10 response distribution divided by perceptions regarding remote workers integration

4.2.11 Q11: Which are the most commonly used strategies to stay productive while working remotely?

When asked which strategies they use to stay productive outside the office environment, the responses submitted by those working, at least occasionally, remotely are presented in Figure 16.

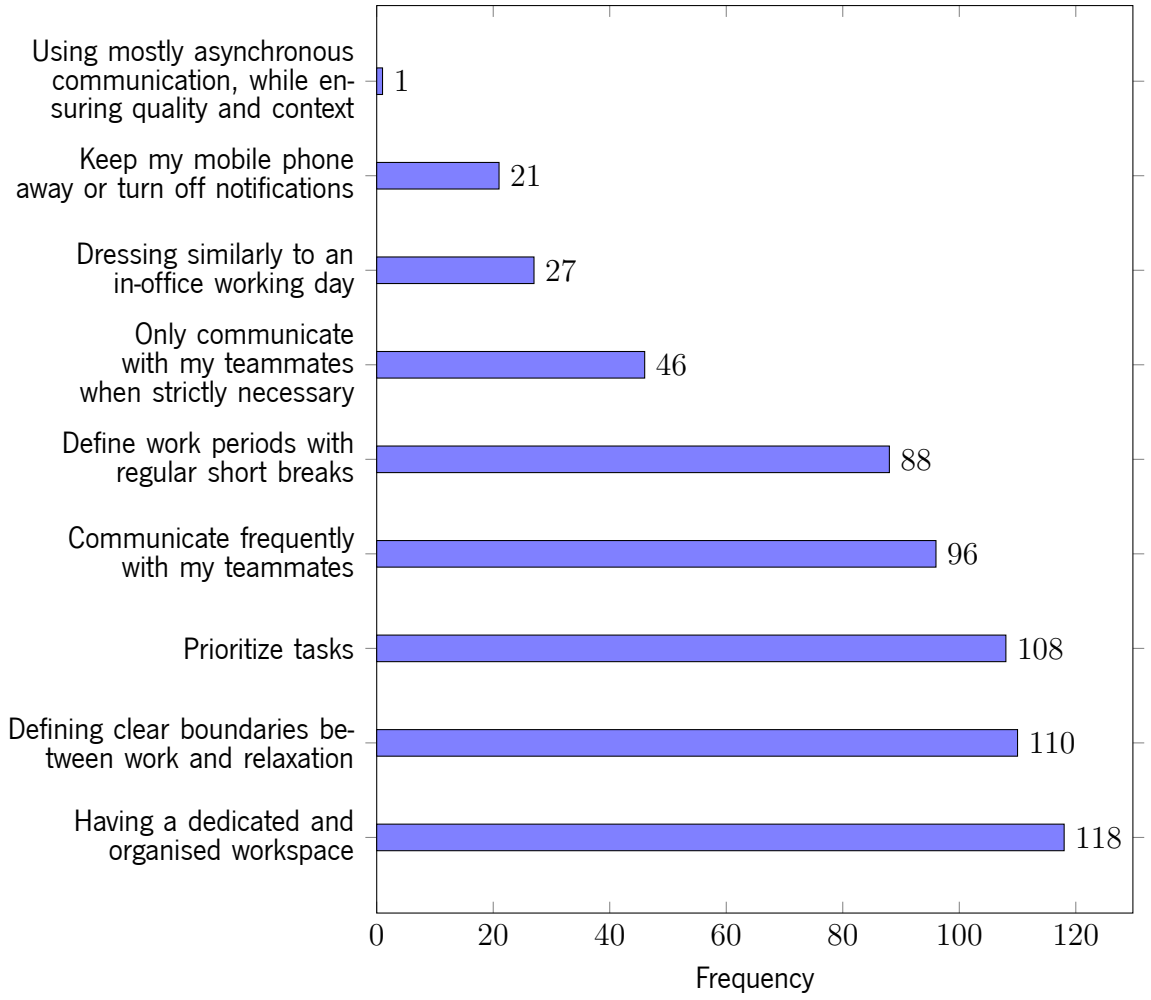

Figure 16: Q11 response frequency

Having a dedicated and organized workspace is the strategy participants value the most to stay productive, followed closely by setting clear boundaries between work and relaxation, and task prioritization. Concerning communication, the results show that participants continuously emphasize the importance of maintaining regular interactions with colleagues rather than only when strictly needed. Defining work intervals with brief pauses is highly valued, while keeping the mobile phone out of sight or dressing in a manner appropriate for an office day are rarely referred to as helpful. In addition to the available response options, another strategy was mentioned, namely "using mostly asynchronous communication, while still paying attention to the quality of it and context".

These results suggest that employers should ensure every worker is able to set up an adequate workspace at home, that they are not disturbed by work-related issues beyond their working hours, and grant autonomy to prioritize their working tasks.

4.2.12 Q12: Are the employers assisting their remote workers in building adequate workspaces?

When asked if they have an adequate workspace at home that allows them to be productive, the responses displayed in Figure 17 were collected.

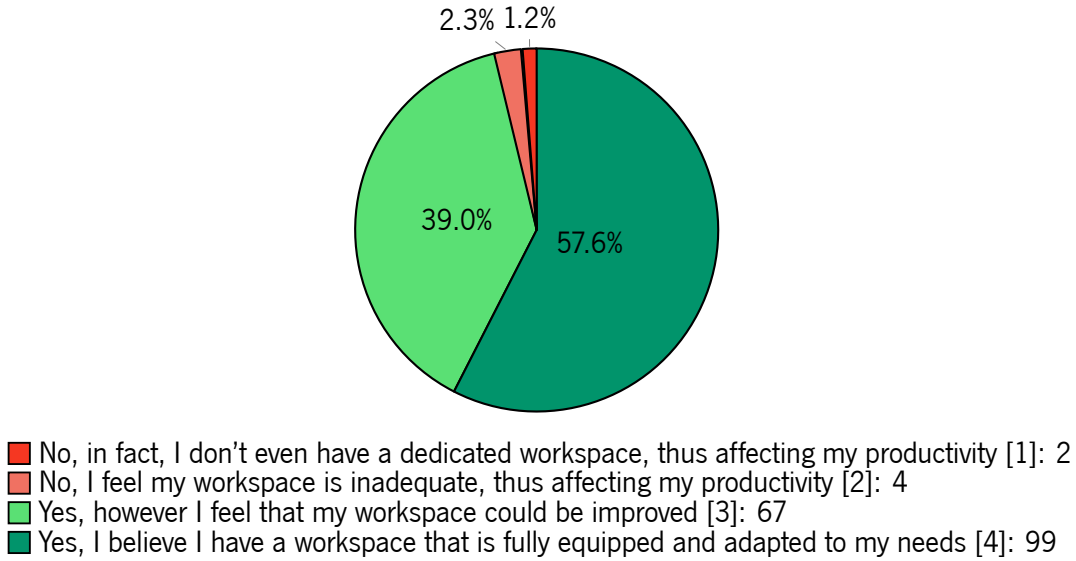

Figure 17: Q12 response distribution

The vast majority (96.6%) of participants declared that they already have an adequate workspace at home. Therefore, only a very small fraction of them claimed facing issues staying productive due to their remote working station.

Additionally, it is possible to compute the median of the responses since the question and available answers somewhat followed the Likert scale displayed in the Figure 17 legend:

	Mode	Median
Q12	4	4.0

Having a median and mode of 4, the report suggests that a significant proportion perceive their home workspaces as fully equipped and adapted to their needs. However, there are still numerous participants who could benefit from some improvements, meaning that perhaps employers could give some assistance in this regard.

4.2.13 Q13: Has the existence of remote workers impacted team dynamics and collaboration?

When asked whether the presence of telecommuting workers within their teams has any impact on the dynamics and collaboration between colleagues, the participants who have been or are part of a team with both remote and in-office members reported the results observable in Figure 18.

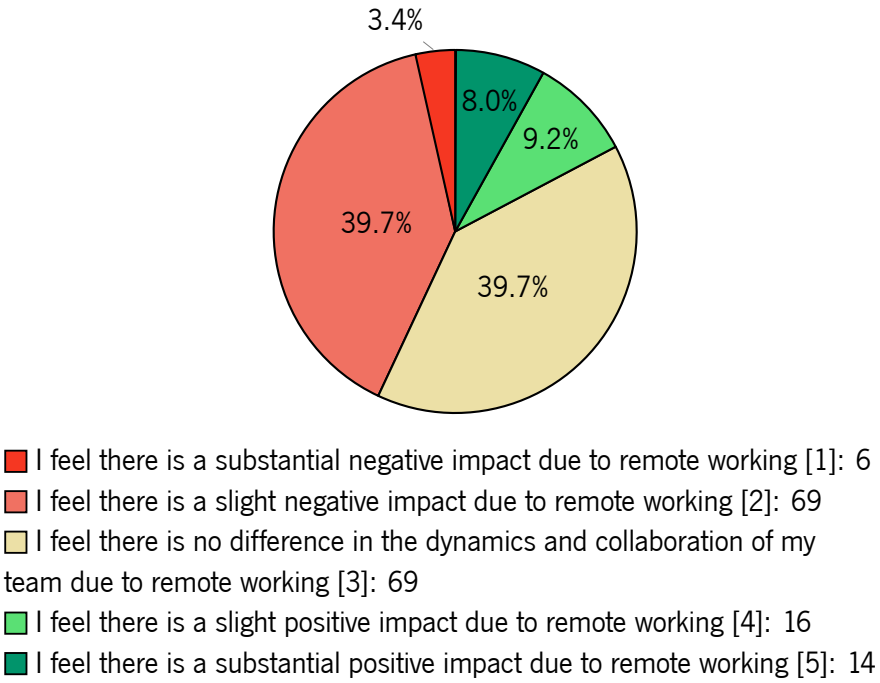

Figure 18: Q13 response distribution

While nearly 40% claimed there is no impact, an equal percentage of them reported a slightly negative effect on collaboration and teamwork dynamics. Interestingly, 17.2% experience some positive outcomes due to the coexistence of remote workers, with 8% of those claiming a substantial improvement. Meanwhile, a minority of 3.4% highlighted substantial negative consequences.

Furthermore, it is possible to convert the answers into the Likert scale listed in the Figure 18 legend and, consequently, to determine the median and mode of the responses:

	Mode	Median
Q13	2 and 3	3.0

The distribution of responses, along with the median of 3.0 and mode of 3 and 4, point to a wide range of perspectives on how remote workers affect team dynamics and collaboration, indicating that it is

crucial to understand how to mitigate any adverse effects caused by it.

Furthermore, it is worth investigating whether the current work regimen and the perceived effect of remote work on team dynamics exhibit any relation:

	Remote work impact on team dynamics						
	Substan. negative	Slight negative	No difference	Slight positive	Substan. positive		
Current regimen	n(%)	n(%)	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
Fully on-site	1 (33.3%)	2 (66.6%)	0	0	0	3*	**FFH exact test** p = 0.078 ϕ_c = 0.219 CI = 95%
Hybrid	5 (3.6%)	59 (42.4%)	52 (37.4%)	11 (7.9%)	12 (8.6%)	139*	
Fully remote	0	8 (25.0%)	17 (53.1%)	5 (15.6%)	2 (6.3%)	32*	

*The aggregate number of answer is 174, not 175, given some participants have never been part of a team composed of on-site and remote workers

Table 16: Q13 results overview

The Fisher-Freeman-Halton exact test results for the Q2 were not statistically significant, as it is conceivable to confirm from the p-value of 0.078 in Table 16. However, it can be asserted that individuals working in a hybrid manner are more likely to report experiencing a negative impact on the team dynamics due to the presence of remote workers than those who work exclusively remotely. Since very few participants reported working entirely on-site, it is not possible to make very accurate observations, however, all of them acknowledged experiencing detrimental consequences. These findings, also observable in Figure 19, can, despite the fact that no statistical significance was achieved, indicate the existence of a relation between the current work regimen and the perception that the presence of remote workers imposes a detrimental impact on team dynamics.

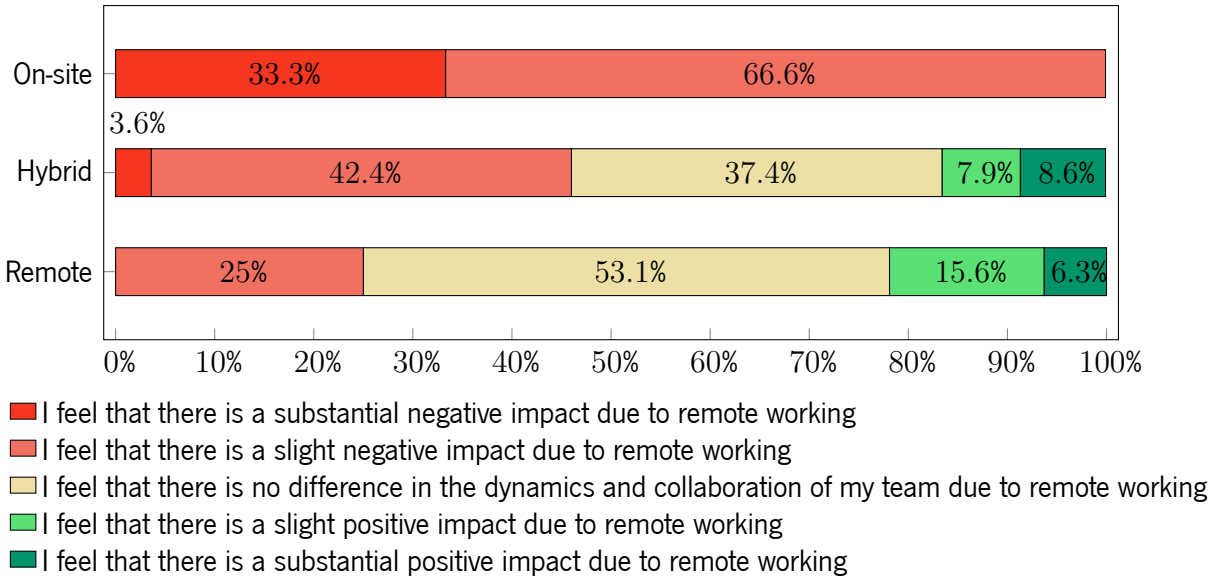

Figure 19: Q13 response distribution divided by current regimen

4.2.14 Q14: What is the overall perception of remote workers' integration into team dynamics?

Figure 20 shows the responses given while asking participants if they thought that remote workers were well-integrated into team meetings and dynamics.

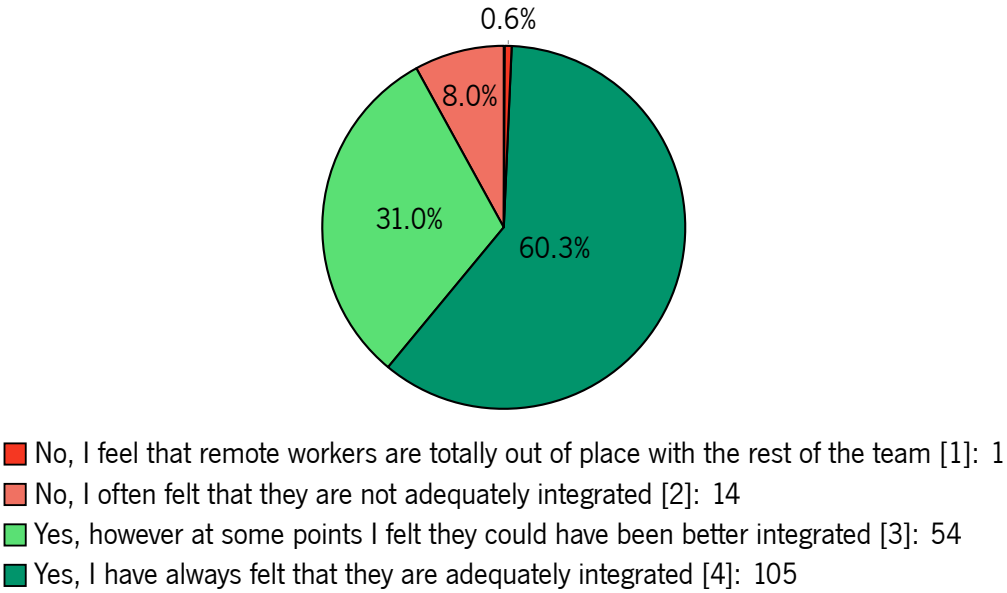

Figure 20: Q14 response distribution

As illustrated in the Figure 20, 60% of the respondents feel like remote workers are consistently adequately integrated. Furthermore, more than 30% believe they are appropriately assimilated into the team,

while also acknowledging occasional thoughts of potential opportunities for further enhancing their level of collaboration. Conversely, the perception that remote employees are somewhat excluded from the team is shared by less than 10% of individuals, being marginal the percentage that reported they are totally left out.

Converting the responses using the Likert scale proposed in the Figure 20 legend, it is possible to compute the corresponding median and mode:

	Mode	Median
Q14	4	4.0

The median and mode corroborate the prior perception that participants generally believe remote workers are adequately integrated.

Similarly to the previous question, it is feasible to analyze if the current work regimens impact workers' perception regarding the integration of those teleworking:

	Perception regarding remote workers integration					
	No, I feel that remote workers are out of place	No, I often feel they're not adequately integrated	Yes, however could have been better integrated	Yes, they're adequately integrated		
Current regimen	n(%)	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
Fully on-site	1 (33.3%)	0	1 (33.3%)	1 (33.3%)	3*	**FFH exact test** p = 0.034 ϕ_c = 0.418 CI = 95%
Hybrid	0	13 (9.3%)	46 (32.9%)	81 (57.9%)	140*	
Fully remote	0	1 (3.2%)	7 (22.6%)	23 (74.2%)	31*	

*The aggregate number of answer is 174, not 175, given some participants have never been part of a team composed of on-site and remote workers

Table 17: Q14 results overview

As exhibited in Table 17, the results proved to be statistically significant, indicating the existence of a relation between the current work regimen and the perspective on the integration of their remote colleagues. The value of ϕ_c, being higher than 0.25, indicates that the relation is very strong.

When comparing the actual and expected counts in SPSS, it is possible to observe that remote workers do not exhibit a higher tendency to report feeling less effectively integrated. In fact, among the three

regimens, they are the more likely to find themselves successfully adapted to the team's dynamics and environment, as corroborated by Figure 21. Furthermore, one can affirm that even individuals embracing a hybrid or in-office arrangement believe their remote coworkers are sufficiently engaged with the team.

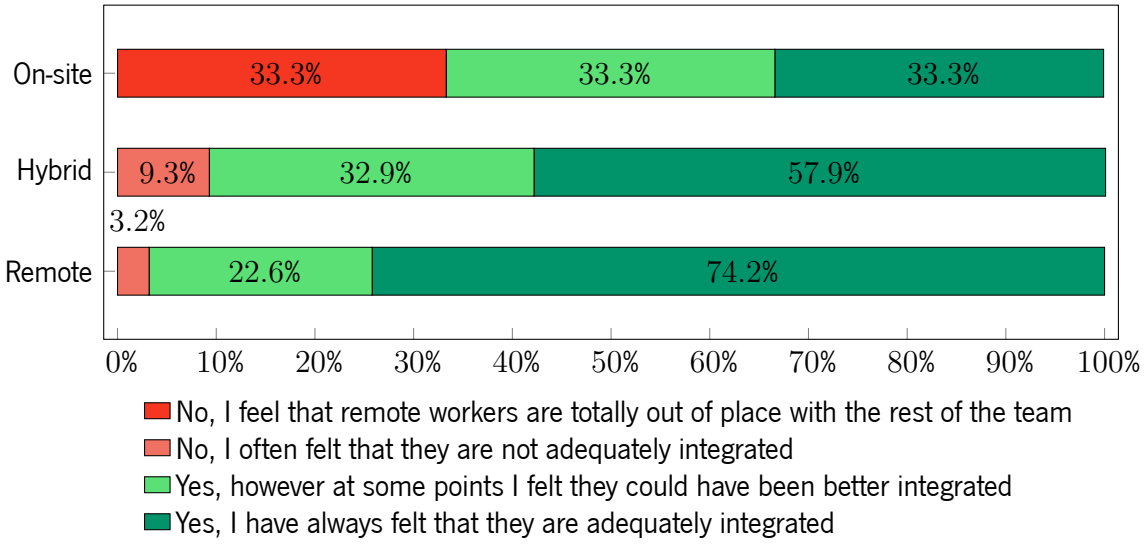

Figure 21: Q14 response distribution divided by current regimen

4.2.15 Q15: To what extent do workers believe that promoting team-building activities or informal conversations would foster team spirit, particularly among remote workers?

When asked if their employer should promote more activities or informal conversations to foster team spirit, participants responded as denoted by Figure 22.

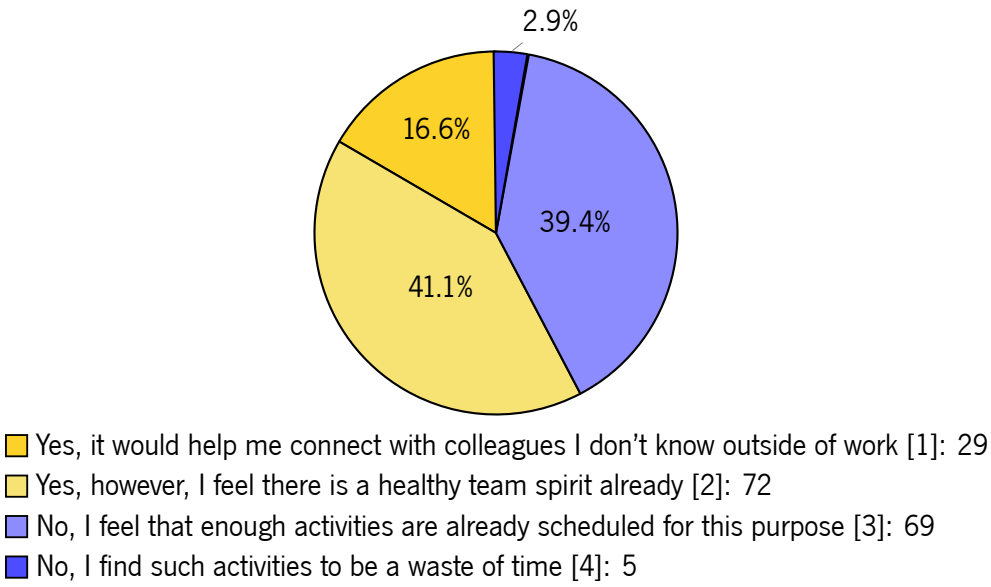

Figure 22: Q15 response distribution

Almost 58% of the participants reported that promoting more activities to foster team spirit would be beneficial, with 16.6% of those adding that it would be helpful to connect with colleagues they have not had the chance to know personally. The number of participants reporting that there are already enough team-building activities being planned is also considerable, representing more than 40% of the responses. However, only a small fraction of them perceive every activity of this nature as a waste of time.

The replies' median and mode can be calculated by converting them into the Likert scale displayed in the Figure 22 legend:

	Mode	Median
Q15	2	2.0

These results suggest that most individuals recognize the importance and potential benefits of team-building activities and that, perhaps, some employers should promote more initiatives to strengthen team cohesion. However, it is crucial to make sure that not too many team bonding events are scheduled.

To evaluate whether the current work arrangement has any influence on this particular topic, the Fisher-Freeman-Halton exact test was once again employed:

	Should more team-building activities be scheduled?					
	Yes, it would help me connect with colleagues...	Yes, however there is an healthy spirit	No, enough activities already	No, they're a waste of time		
Current regimen	n(%)	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
Fully on-site	1 (33.3%)	1 (33.3%)	0	1 (33.3%)	3	**FFH exact test** p = 0.196 ϕ_c = 0.187 CI = 95%
Hybrid	24 (17.1%)	58 (41.4%)	55 (39.3%)	3 (2.1%)	140	
Fully remote	4 (12.5%)	13 (40.6%)	14 (43.8%)	1 (3.1%)	32	

Table 18: Q15 results overview

As it is possible to see in Table 18, the results lacked statistical significance. Comparing the distribution in Figure 23, it is evident they were quite similar between the hybrid and remote workers, with a slight tendency for those who work in a hybrid setting to endorse scheduling more team-building activities. Therefore, one can conclude that, despite not being able to socialize face-to-face with their team members, remote workers are not more likely to advocate the need for such activities. It is conceivable to conjecture that, due to being geographically far from the office, some of them may not endorse the idea of scheduling in-person events, but, with no further data, it is impossible to confirm such a theory.

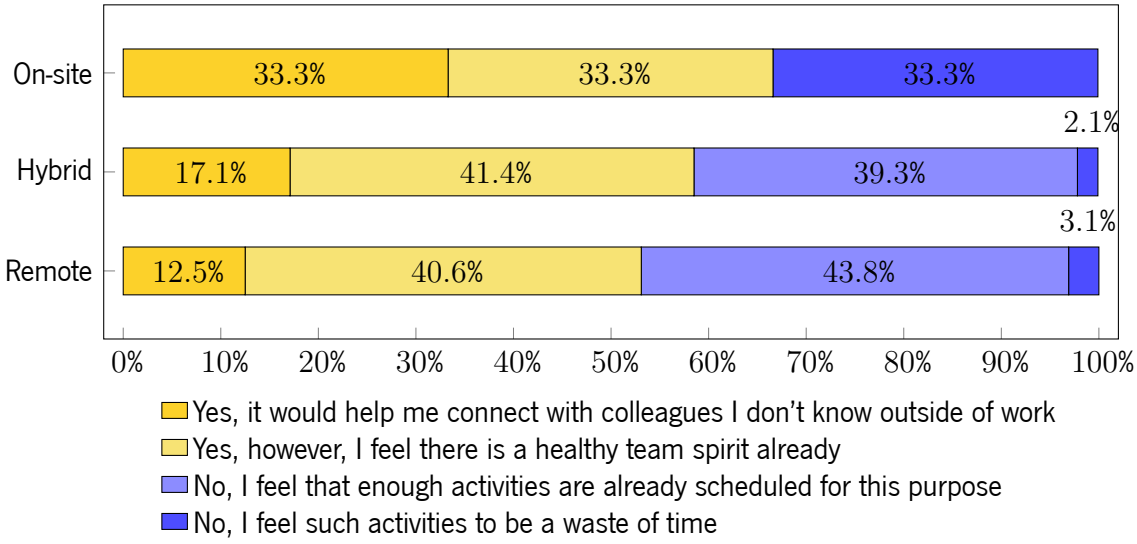

Figure 23: Q15 response distribution divided by current regimen

4.2.16 Q16: How do employees perceive the effect of remote work on productivity hindrances caused by meetings or delays in addressing simple questions that could be resolved quickly in an office mode?

Participants were asked to report whether the use of virtual communication results in hindrances to their productivity. They provided the responses shown in Figure 24.

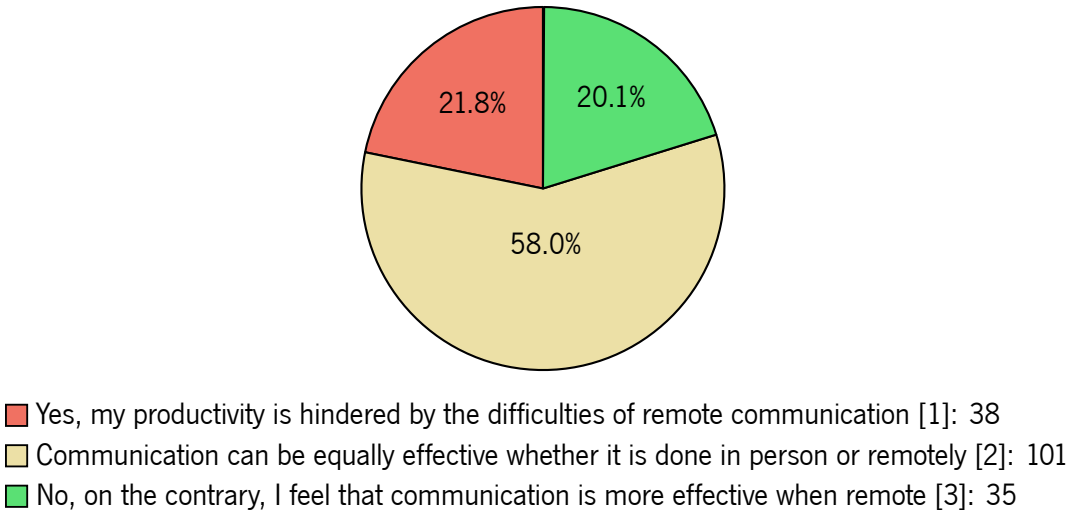

Figure 24: Q16 response distribution

A majority of the respondents reported that face-to-face and remote communication can be equally effective. Interestingly, similar numbers of participants claimed that their productivity is either being hindered or improved due to remote communication.

By converting the responses using the Likert scale specified in the caption of Figure 24, the corresponding median and mode were computed:

	Mode	Median
Q16	2	2.0

These findings indicate that, for most participants, the use of virtual communication is not producing any negative or positive effects on productivity. However, since a sizeable percentage of professionals feel like their productivity may be hindered, every team must evaluate their communication and, if required, make adjustments to it.

As with the prior questions, it is appropriate to verify whether the work regimen influences the aforementioned subject matter:

	Remote work impact on communication				
	Productive hindered by remote communication	Equally effective	More effective when remote		
Current regimen	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
Fully on-site	2 (66.6%)	1 (33.3%)	0	3*	**FFH exact test** p = 0.022 ϕ_c = 0.184 CI = 95%
Hybrid	32 (22.9%)	85 (60.7%)	23 (16.4%)	140*	
Fully remote	4 (12.9%)	15 (48.4%)	12 (38.7%)	31*	

*The aggregate number of answer is 174, not 175, given some participants have never been part of a team with remote coworkers

Table 19: Q16 results overview

According to the p-value in Table 19, the Fisher-Freeman-Halton exact test results were statistically significant, meaning there exists a relation between the participants' current work regimen and the perception regarding the effectiveness of communication in a remote setting. Comparing the expected and actual counts in SPSS, it is possible to confirm that remote workers perceive remote communication as more effective. Additionally, it is also possible to observe that those working in a hybrid setting tend to perceive communication as equally effective regardless of it being remote or in-person. Having a value of ϕ_c equal to 0.184, it is possible to affirm that the relation is strong.

These findings are corroborated by Figure 25. Fully remote workers are more likely to report that communication is more effective when remote and less likely to feel that communication is interfering with their productivity. Furthermore, the hybrid workers were the most common to assert that the context of the communication does not alter its effectiveness. Once again, due to the extremely limited participation of in-office workers, little can be stated about them. However, it is worth mentioning that two out of the three claimed that using virtual communication has a detrimental impact on their work.

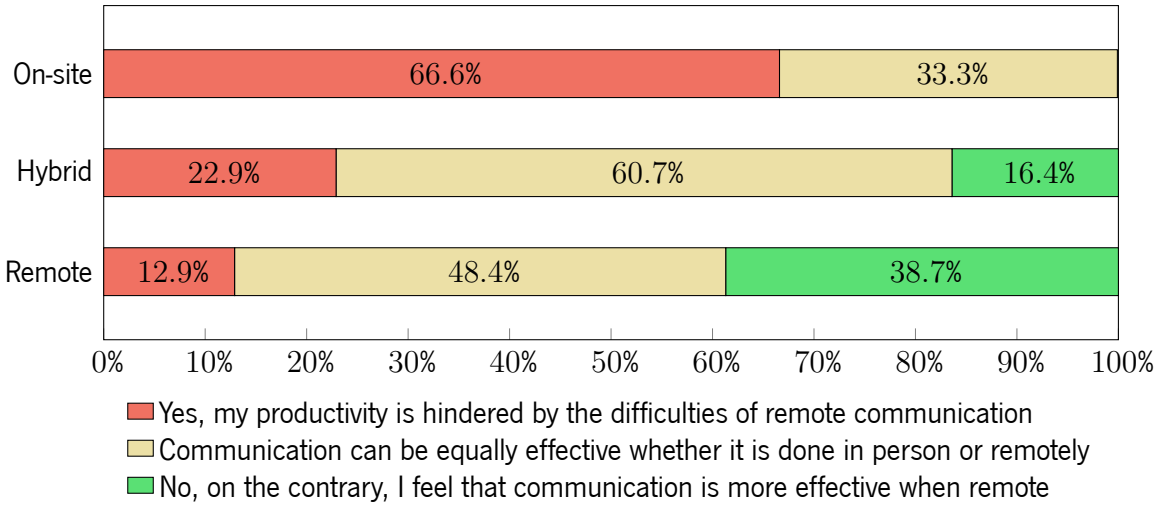

Figure 25: Q16 response distribution divided by current regimen

4.2.17 Q17: Do the remote employees believe they have the same opportunities to be promoted as their coworkers who attend the office?

When asking those who exclusively work remotely if they believe that equal opportunities to be promoted are being offered both to them and their colleagues who work in-office, the report presented in Figure 26 could be derived.

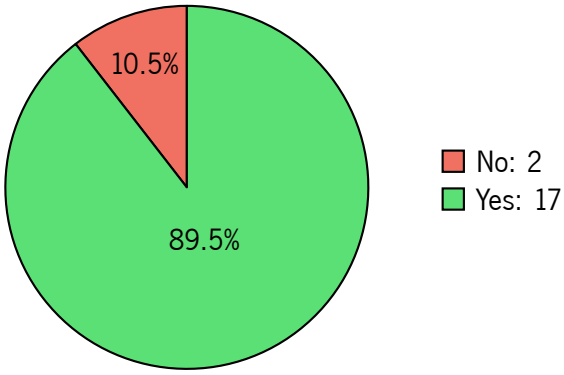

Figure 26: Q17 response distribution

Almost 90% of the fully remote participants assured confidence in receiving comparable promotion opportunities as their colleagues who attend the office every week. Despite the overall positive sentiment, it is worth highlighting that some participants expressed an unfavorable sense of disparity with respect to career development opportunities.

4.2.18 Q18: Is there a relationship between the work environment where participants fell more productive and their assessments of the effects of remote work on communication?

Building a contingency table and employing the Fisher-Freeman-Halton exact test, as illustrated in Figure 20, it is possible to ascertain whether the perceptions regarding remote communication have any effect on productivity discrepancies between work environments.

	In which regimen do the participants fell more productive?						
	Substan. on-site	Slight on-site	No difference	Slight remotely	Substan. remotely		
Perception of remote communication	n(%)	n(%)	n(%)	n(%)	n(%)	Answer count	Used statistic p value effect size confidence interval
Is more effective when remote	1 (2.9%)	4 (11.4%)	6 (17.1%)	8 (22.9%)	16 (45.7%)	35*	**FFH exact test** p = 0.009 ϕ_c = 0.253 CI = 95%
Can be equally effective	1 (1.0%)	9 (9.0%)	29 (29.0%)	25 (25.0%)	36 (36.0%)	100*	
Productivity is hindered due to remote communication	4 (10.8%)	11 (29.7%)	5 (13.5%)	8 (21.6%)	9 (24.3%)	37*	

*The aggregate number of answer is 172, not 175, given some participants have never been part of a team with remote coworkers or have never worked both in-office and remotely

Table 20: Q18 results overview

Statistical significance was demonstrated by the Fisher-Freeman-Halton exact test, proving there is a relation between the work environment where participants feel more productive and their perceptions of how teleworking affects team communication. As expected, the results demonstrated that those who reported feeling like communication is more effective when remote tend to argue that they achieve higher productivity when teleworking. Similarly, noticing productivity hindrances due to the use of virtual communication means a slight propensity to neglect the contribution of remote work to enhance performance. However, some contradictory responses were observable, given that several individuals believe they are more efficient when teleworking, even while claiming that online communication deteriorates productivity. The ϕ_c value revealed that the relation is very strong.

Figure 27 helps corroborate the aforementioned observations:

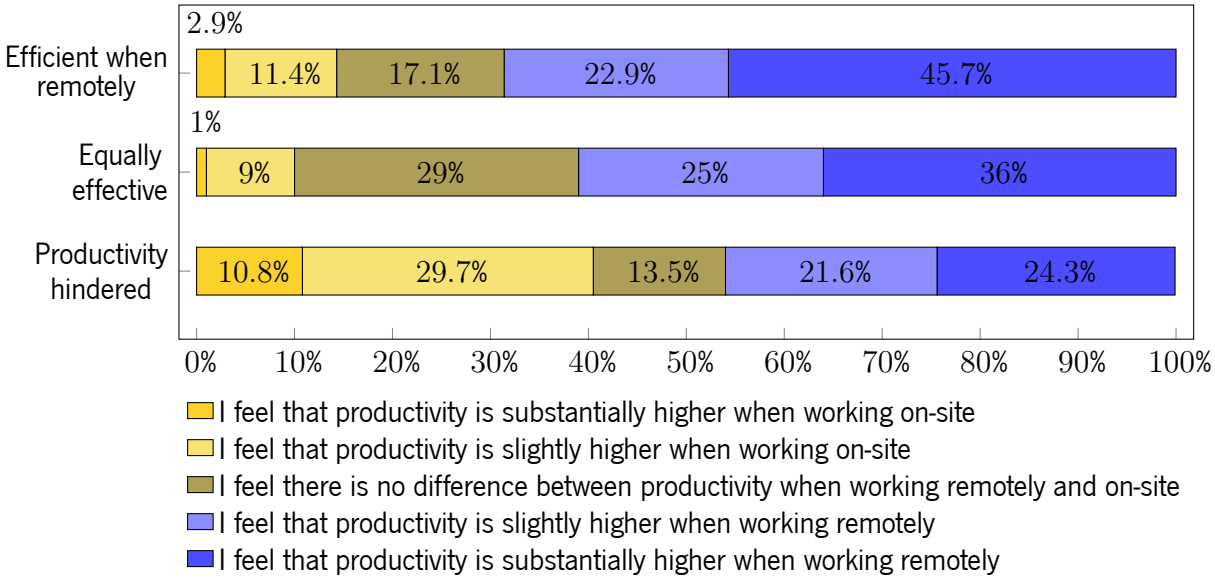

Figure 27: Q18 response distribution divided by perceptions regarding communication

4.2.19 Q19: Which strategies have teams implemented to optimize the adoption of remote working?

In order to answer this question, participants were encouraged to either identify strategies that their team had already implemented or to suggest additional practices in order to improve the adoption of remote work. A variety of proposals was presented, however, some subjects emerged repeatedly:

Regarding meetings, the most frequently cited strategy was to regularly schedule short sync-up sessions with the team. Other repeatedly mentioned suggestions included ensuring that meetings are either exclusively virtual or face-to-face (or at least as remote-friendly as possible), making sure everyone uses their webcam, and remaining continuously present in a video conference with their colleagues.

Furthermore, and building upon the discussion on communication, several practices aimed at improving the effectiveness of asynchronous communication. Among them, the one that emerged as the most recurrently cited was maintaining open communication channels for any kind of message. Other commonly referenced strategies were prioritizing async communication over the use of video conference, sending messages rather than calling to avoid disturbing their colleagues, and seeking assistance whenever doubts or hurdles arise.

Concerning socialization within the team, the participants suggested scheduling more team-building events and organizing frequent socialization-oriented activities, either in the office or remotely, like an informal meeting or having lunch together every week.

Other proposals included having designated days when everyone should be at the office, endorsing the employers' responsibility to ensure the workers' home office is adequate and, if needed, providing equipment to upgrade it, putting more effort into documenting the projects and organizations' internal producers, encouraging in-person onboarding processes, conducting face-to-face brainstorming discussions, establishing designated spaces in the office for both online and face-to-face conferences, and having 1:1 appointments with their managers concerning professional alignment.

Chapter 5

Conclusions and Future Work

5.1 Conclusions

The COVID-19 outbreak forced software development professionals to work from home for several months. As a result, the work dynamics of both professionals and teams were, for the most part, entirely modified and adapted to this new and prolonged reality. It is within this context that this dissertation's primary objective is to study the long-term repercussions of the aforementioned period and to depict the current scenario of the now voluntary adoption of remote working among software development teams in Portugal.

To accomplish that, this dissertation comprises a state-of-the-art analysis of the articles discussing the effects of the COVID-19 pandemic on software development teams. The articles were sourced from both the post-pandemic period, in which this study is set, and the compulsory teleworking era due to the recent easing of the COVID-19 restrictions.

With the intention of studying the current reality in Portugal, the data collection tool, the target audience, the questions to be answered by the questionnaire and its structure, a justification for each section, and a brief description of the sample are all characterized.

Lastly, the methodology employed to analyze the data is detailed, and the results of each question are presented.

5.1.1 Questionnaire and Survey Overview

The questionnaire consists of 6 sections and a maximum of 25 questions. The first two sections intended to collect the participants' demographic and career-related information, as well as to exclude any invalid contributions. Consequently, it was possible to determine that participation was essentially restricted to those between the ages of 18 and 50, that 72% of the participants were male, 86.3% were

Portuguese natives, 87.4% had a master's or bachelor's degree, that despite the homogeneous participation in this metric, 29.1% of the professionals had between 2 and 5 years experience in the field and, additionally, that the most represented positions were full-stack developer, back-end developer and front-end developer.

The remaining four sections of the questionnaire were designed to collect data on the participants' working arrangements before and after the pandemic, their perceptions regarding productivity, identify and address any issues with remote working, and, finally, learn which working arrangements professionals prefer along with the factors influencing such preferences.

In total, 199 entries were collected, but only 175 were considered valid, i.e., those that claimed to formally be a member of a software development team.

5.1.2 Results Overview and Conclusions

Taking into account the objectives set forth by this dissertation, the analysis of the collected data has led to the following findings:

How prevalent is remote work in the period following the COVID-19 pandemic? (RQ1)

1. The hybrid regimen is, by far, the most popular among the software development team members, while the face-to-face regimen is unequivocally the least favored.

2. These trends are in line with workers' preferences, given that the hybrid system is favored by the majority of them. It is noteworthy, however, that although approximately a third of those surveyed said they would prefer to embrace the exclusively remote regimen, only slightly more than half of them are actually doing so, indicating that companies may still be reluctant to allow their workers to work entirely from home.

3. The reports detailing employer flexibility confirm such reservations, given that a substantial proportion of companies do not allow the fully remote arrangement. Nonetheless, the preference for a hybrid system seems to be shared by both employees and employers since most companies do not allow exclusively on-site schedules, and no company forces employees to follow a strict in-office arrangement.

4. It is clear, however, that this is a reality driven by the COVID-19 pandemic since there has been a substantial shift in workers' work habits from conventional in-office work towards hybrid and remote arrangements between the period preceding and subsequent to the pandemic.

5. It is also possible to affirm that being able to adopt the preferred working regimen is highly valued, with more than half of those surveyed reporting that they would reject any proposal invalidating the adoption of their favorite regimen. This also serves as a wake-up call for employers, who, at the risk of losing the opportunity to attract talent, must be as flexible as possible when it comes to working arrangements.

6. Finally, it became evident that the distributions between schemes vary according to the years of experience in the field. Of those who have been working in the area for less than a year, the overwhelming majority embrace hybrid working, which may indicate that while they do not plan to come into the office daily, both they and their teams value weekly face-to-face contact.

What are the benefits and downsides associated with remote working from the perspective of the software developers? (RQ2)

1. When asked about their primary motivations, the possibility of avoiding traveling to the office stood out among both those who prefer the remote system and those favoring the hybrid system. They claimed they could save time and money while avoiding additional fatigue. Also shared by both groups was the possibility of benefiting from a healthier work-life balance, allowing workers to spend more time with their families, dealing with personal matters, or having more time for leisure. Similarly, participants adhering to either regimen reported being able to benefit from more comfort, a working environment better adapted to their needs, and, consequently, an increase in productivity.

2. Evidently, motivations were not universally shared between individuals favoring daily teleworking and those opting to work both in-person and remotely. According to the participants, the hybrid regimen allows them to socialize with their teammates and thus strengthen team spirit, as well as giving them the flexibility to choose when to work remotely and when to go into the office. As for remote workers, they specifically highlighted the advantage of being able to reside anywhere as a distinctive benefit.

3. However, it is not solely reflecting upon the participants' explicitly mentioned motivations that their preferences are recognizable. When analyzing the data from other indicators, it was possible to observe two patterns: those who feel that there is an effective integration of remote workers tend to favor the remote or hybrid regimen, and an evident inclination exists to prefer the regimen in which they judge themselves to be most productive.

How can remote work be more productive? (RQ3)

1. Having a designated and organized workstation, defining boundaries between work and leisure, taking regular breaks during work hours, prioritizing tasks, and often interacting with coworkers are the tactics that participants who perform some work remotely value the most.

2. It was possible to check with members of software development teams whether they have a home workspace equipped to meet their needs. The results showed that more than half of the respondents believe their workstation fully satisfies their demands, while virtually all the others affirmed that despite room for improvement, they can be productive. Meanwhile, only a marginal fraction experiences productivity hindrances due to their workspace. This suggests that, although employers may be ensuring their remote workers have the essential equipment to be productive, additional assistance could be helpful.

What challenges do the coexistence of remote and in-office work imposes? (RQ4)

1. Before understanding how to make the coexistence of remote and face-to-face work more effective, it is crucial to detect any problems. When asked about the impact of having members of their team working remotely, professionals often report a slightly detrimental effect, especially among those who work little or no days outside the office setting.

2. As for the integration of remote workers, overall, the professionals believe that they are adequately incorporated into the team's dynamics and meetings. It is noteworthy to mention that those who work solely remotely almost unanimously regard themselves as effectively integrated.

3. As a way of understanding how to improve this integration, they were asked about the necessity of team-building activities. The results revealed that while almost everyone values them, a sizable portion thinks that enough activities are already scheduled for this purpose.

4. Even though the reports regarding communication were quite diverse, they suggest that the use of remote interactions does not have a substantial negative impact on team productivity. However, a sizable number of those who work either in-office or in a hybrid setting believe that their productivity is somewhat hindered due to the usage of virtual communication.

5. Most remote workers hold the belief that they have the same promotional opportunities as their office-based teammates.

6. Overall, these results suggest that, despite the reported slight negative impact of remote working, teams are working to address its challenges. Those teleworking are adequately integrated, team-building activities are helping to improve team spirit, equal opportunities are being assured regardless of working arrangements, and virtual communication is not hindering productivity.

How can the synergy between remote and in-office work be enhanced? (RQ5)

1. When explicitly asked how to improve the coexistence of remote and face-to-face work, the responses exhibited a pronounced heterogeneity. However, the most frequently mentioned proposals were to schedule brief sync-up meetings on a regular basis, ensure that meetings are held only in person or exclusively remotely, maintain the availability of communication channels, favor asynchronous communication whenever possible, schedule more team-building activities, arrange shared office working days, having assistance from employers to equip home working spaces and improve documentation.

5.1.3 Literature Parallelism

The articles presented in Chapter 2 offer the opportunity to contrast prior knowledge with the reality detailed over the course of this dissertation. Despite that, it is crucial to recall that nearly all of those articles delve into the pandemic period, which may have tainted their conclusions. Some of the challenges felt by the developers were predominantly caused by the compulsory lockdown and, consequently, by the obligation to have all the members of the teams working remotely, with many of them doing so for the first time.

With that being said, the findings in Q1, Q2 and Q13 are in line what Wang et al. [2021], Schmidtner et al. [2022] and Garro-Abarca et al. [2021] conclude:

- Wang et al. [2021] who affirm that when it was again possible to work in the office, a substantial portion of the developers opted for the hybrid arrangement.
- Schmidtner et al. [2022] who inquired managers and conclude that more than half of them expect the percentage of developers working remotely to increase in the post-pandemic period.
- Garro-Abarca et al. [2021] who report that a significant portion of the developers surveyed planned to work fully or partially remotely when the COVID-19 restrictions have ended.

The findings in Q14 regarding the justifications to opt for a remote, hybrid, or in-office arrangement are consistent with numerous articles:

- Johri [2011], Garro-Abarca et al. [2021], Wang et al. [2021], Ford et al. [2021], Butler and Jaffe [2021], Topp et al. [2022] and Smite et al. [2022] also report avoiding the need to commute as a reason to favor a remote regimen.

- Sikes et al. [2011], Johri [2011], Wang et al. [2021], Ford et al. [2021], Butler and Jaffe [2021] and Smite et al. [2022] also conclude that remote work had positive effects on work-life balance and allowed the workers to spend more time with their families.

- Sikes et al. [2011], Neumann et al. [2021], Das et al. [2021], Wang et al. [2021], Ford et al. [2021], Topp et al. [2022], Smite et al. [2022], similarly mention having a more comfortable, controlled, and distraction-free work environment as one of the advantages of working remotely.

- Johri [2011] likewise determine that having the possibility to live anywhere made remote work more appealing.

- Weinert et al. [2014], Neumann et al. [2021], Wang et al. [2021], Ford et al. [2021], Rodeghero et al. [2021], Miller et al. [2021], Topp et al. [2022] and Smite et al. [2022] claim that the absence of socialization was a major drawback of remote work. This reinforces the conclusion that one of the pivotal benefits of both the hybrid and in-office arrangements is the ability to remain socially connected with the team.

Some of the suggestions presented in Q12 for improving the adoption of remote work coincide with various articles:

- Bezerra et al. [2020], Russo et al. [2021], Ford et al. [2021] and Smite et al. [2022] also notice that the workers believed their employers should financial aid or provide equipment to upgrade their home offices.

- Russo et al. [2021], Rodeghero et al. [2021], Miller et al. [2021], Schmidtner et al. [2022] and Topp et al. [2022] similarly advocate the need to schedule more socialization focused events.

- Das et al. [2021] and Rodeghero et al. [2021] also perceive the requirement for everyone to use their webcam as a way to improve remote meetings.

- Bezerra et al. [2020] and Ford et al. [2021] affirm that fewer meetings should be scheduled, emphasizing the argument that asynchronous communication should be prioritized.

- Sikes et al. [2011], Rodeghero et al. [2021], Miller et al. [2021] likewise recommend managers to maintain frequent communication with their team members.
- Rodeghero et al. [2021] also emphasize the need to have updated and readily available documentation.

5.2 Study Limitations

Acknowledging the limitations of this dissertation and finding solutions to minimize them is crucial in evaluating its contribution to the software industry. Therefore, the threads to validity are outlined based on the four categories enumerated by Wohlin et al. [2000]: internal validity, construct validity, conclusion validity, and external validity.

5.2.1 Internal Validity

A questionnaire prototype was used to gather some replies and identify any potential design flaws that could impede them from providing insightful information.

5.2.2 Construct Validity

To prevent participants from submitting inaccurate or biased answers merely because they perceive their team's or their personal productivity is being evaluated, the questionnaire explicitly informed that every response would remain anonymous and used exclusively for academic purposes.

5.2.3 Conclusion Validity

Conclusions were exclusively derived from the information obtained through the questionnaire. Nonetheless, for some questions, no statistically significant results were obtained, meaning that erroneous inferences may have been made.

5.2.4 External Validity

Some of the study's primary limitations can be attributed to the survey sample, mainly due to the use of a non-probability sampling method. Furthermore, the fact that some companies have a significant number of answers that do not always accurately reflect their dimension, the fact that most software development team representatives contacted belonged to companies located in the regions of Braga and Porto, as well

as the small sample size, may limit the possibility of generalizing the findings to a larger population. Also, regarding the sample, it is crucial to acknowledge that a comprehensive study on employees embracing the in-office regimen was practically impossible due to the scarce number of participants working on such an arrangement. Additionally, some on-site workers may have dropped out from the survey because, based on the questionnaire's title, they erroneously believed that only remote workers were eligible.

5.2.5 Additional Limitations

Due to the relatively recent end of the pandemic, most of the articles comprised in the state-of-the-art research are not perfectly integrated into the context of this study, because they solely investigate the time before and throughout the COVID-19 crisis.

5.3 Prospect For Future Work

While this dissertation provides valuable knowledge into the current remote work scenario among Portuguese software development teams, future research can still enhance and broaden our understanding of this topic. A new state-of-the-art analysis only composed of articles that relate to the post-pandemic context can possibly be conducted. Moreover, the study's scope can be broadened by surveying the same population in other nations, and more robust results can be achievable if more answers are obtained. Therefore, it would be wise to send the same questionnaire to additional members of development teams. Confirming whether or not the in-office arrangement is as uncommon as this study contends would be especially important. If conflicting results emerged, it would be essential to undertake another research project including more in-office workers. Conducting the same survey could also allow us to understand how the remote work adoption is progressing. In order to detect possible biased responses, perhaps only answered with the purpose of endorsing the availability of remote work, it could be suitable to use a triangulation method of data collection. Additionally, a more in-depth insight into the phenomenon could be accomplished by gathering the managers' perspectives on remote work as an independent survey. Lastly, we plan to publish the major results of this dissertation as a scientific article in a prestigious journal.

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Part III
Appendices

Appendix A
Questionnaire

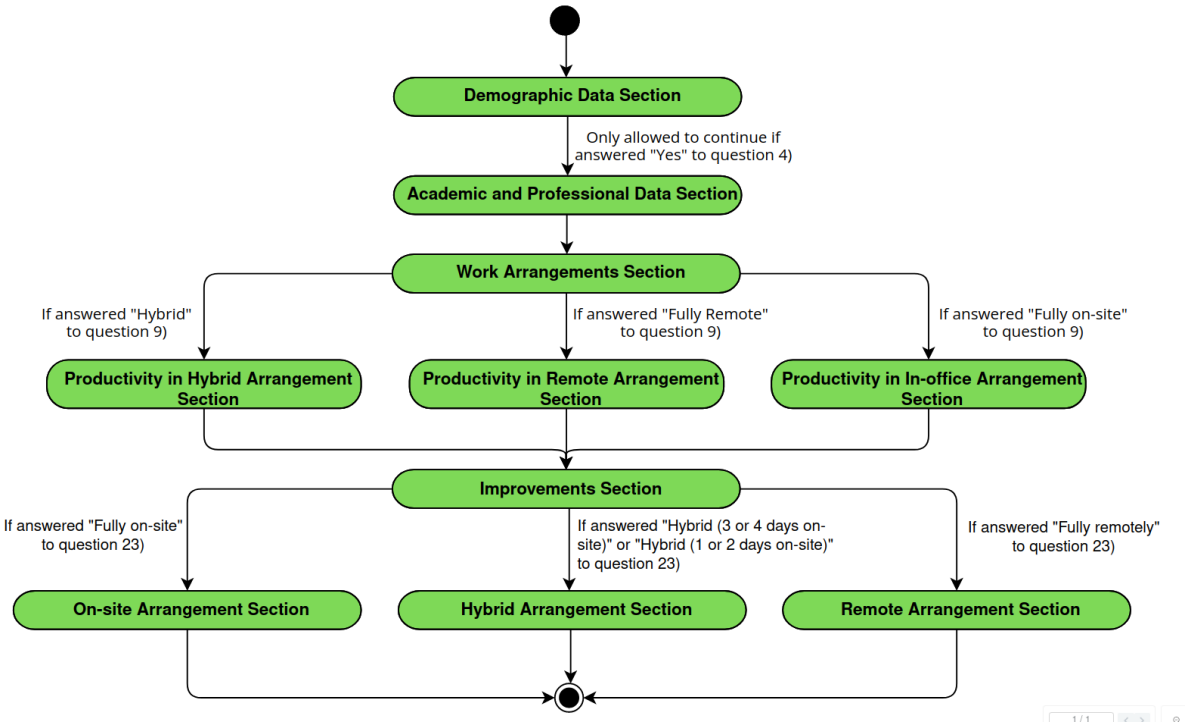

Figure 28: Questionnaire structure

Analysis of the teleworking adoption in the post-pandemic period

My name is Filipe Costa and I'm an MSc student in Informatic Engineering at the University of Minho. As part of my master's thesis, I'm developing an analysis of the remote working
adoption among Portuguese software development teams.

With this questionnaire, I intend to collect data that will allow me to understand:

- which is the preferred work regimen among the members of the software development teams;
- the motivations behind such choices;
- how much flexibility is offered by employers;
- analyse how to make the coexistence between remote and on-site work more productive;
- allow for greater flexibility for workers without prejudice to teams and employers.

The questionnaire is completely anonymous and only intended for members of software development teams, whether they work remotely or on-office. It is composed of a maximum of 25 questions (only two of which are open-ended ones) and should take no more than 7 minutes.

Should you have any questions or wish to receive the dissertation, please feel welcome to contact me, at the following email address: pg47179@alunos.uminho.pt

Thank you in advance for your collaboration.

* Indicates required question

1. This study does not include any form of financial compensation, nor is it financed by any external entity, and participation in it is entirely voluntary. *

   Full confidentiality of the collected data will be ensured, and it will only be used for academic purposes.

   Mark only one oval.

   ◯ I declare that I am aware that the data I have provided is confidential and anonymous, and I authorize its use for academic purposes.

Demographic data

2. 1) What is your age group? *

Mark only one oval.

- ◯ 18-25 years
- ◯ 26-35 years
- ◯ 36-50 years
- ◯ 51-65 years
- ◯ 65+ years

3. 2) What is your gender? *

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ I prefer not to say
- ◯ Other: _____

4. 3) Where were you born *

Mark only one oval.

- ◯ Portugal
- ◯ Brazil
- ◯ Angola
- ◯ Cabo Verde
- ◯ Guinea-Bissau
- ◯ Mozambique
- ◯ São Tomé and Príncipe
- ◯ Afghanistan
- ◯ Albania
- ◯ Algeria
- ◯ American Samoa
- ◯ Andorra
- ◯ Antigua and Barbuda
- ◯ Argentina
- ◯ Armenia
- ◯ Aruba
- ◯ Australia
- ◯ Austria
- ◯ Azerbaijan
- ◯ Bahamas, The
- ◯ Bahrain

5. 4) Are you part of a professional software development team? *

Mark only one oval.

- ◯ Yes
- ◯ No

Academic and Professional Data

6. 5) What is your academic background? *

Mark only one oval.

- ◯ High school
- ◯ Bachelor's degree
- ◯ Masters
- ◯ PhD
- ◯ Other: _____

7. 6) How many years of experience do you have in the software development industry? *

Mark only one oval.

- ◯ Less than a year
- ◯ 1-2 years
- ◯ 2-5 years
- ◯ 5-10 years
- ◯ 10-20 years
- ◯ 20+ years

8. 7) What is your job position at the company? *

Mark only one oval.

- ( ) Back-End Developer
- ( ) Front-End Developer
- ( ) Mobile Developer
- ( ) Data Scientist
- ( ) Product Designer
- ( ) Product Manager
- ( ) Full-Stack Developer
- ( ) Security Engineer
- ( ) Project Manager
- ( ) DevOps Engineer
- ( ) System Administrator
- ( ) Graphics Developer
- ( ) Test Engineer
- ( ) Performance Engineer
- ( ) Database Administrator
- ( ) Scrum Master
- ( ) Business Analyst
- ( ) UI/UX Designer
- ( ) Machine Learning Engineer
- ( ) Other: _____

9. 8) What is the name of the company you currently work for? *

In this question, **the information collected will not be disclosed** and will only be used to identify possible biased results

_____

Work arrangements

10. 9) In which of the following arrangements are you currently working? *

Mark only one oval.

- ◯ Fully on-site *Skip to question 23*
- ◯ Hybrid *Skip to question 14*
- ◯ Fully remote *Skip to question 18*

11. 10) Select all arrangements in which you worked in the pre-pandemic period as part of software development teams *

Pre-pandemic refers to the time period **before March 2020**

Tick all that apply.

- ☐ Fully on-office
- ☐ Hybrid
- ☐ Fully remote
- ☐ I had never worked in software development before the COVID-19 pandemic

12. 11) Select all arrangements in which you worked in the post-pandemic period as part of software development teams. *

Post-pandemic refers to the time period **between March 2022 and today**

Tick all that apply.

- ☐ Fully on-office
- ☐ Hybrid
- ☐ Fully remote

13. 12) How much flexibility does your employer currently offer with regard to remote working? **(please select all that apply)** *

Tick all that apply.

- ☐ Allows full on-office arrangement
- ☐ Allows hybrid arrangement
- ☐ Allows full remote arrangement

Productivity in hybrid arrangement

14. 13) Do you feel there is any difference between the productivity achieved when working on-office versus remotely? *

Mark only one oval.

- ◯ I feel that productivity is substantially higher when working remotely
- ◯ I feel that productivity is slightly higher when working remotely
- ◯ I feel there is no difference between productivity when working remotely and on-office
- ◯ I feel that productivity is slightly higher when I work on-office
- ◯ I feel that productivity is substantially higher when I work on-office

15. 14) What strategies do you use to stay productive when working remotely? **(select all that apply)**

Tick all that apply.

- ☐ Communicate frequently with my teammates
- ☐ Only communicate with my teammates when strictly necessary
- ☐ Defining clear boundaries between work and relaxation
- ☐ Define work periods with regular short breaks
- ☐ Prioritize tasks
- ☐ Having a dedicated and organised workspace
- ☐ Keep my mobile phone away or turn off notifications
- ☐ Dressing similarly to an on-office working day
- ☐ Other: _____

16. 15) When working remotely, do you think you have an adequate workspace that allows you to be productive? *

Mark only one oval.

- ◯ Yes, I believe I have a workspace that is fully equipped and adapted to my needs.
- ◯ Yes, however I feel that my workspace could be improved
- ◯ No, I feel my workspace is inadequate, thus affecting my productivity
- ◯ No, in fact, I don't even have a dedicated workspace, thus affecting my productivity

17. 16) On average, how many extra hours per day are you forced to work beyond your working hours? *

Consider only the time period after the end of mandatory remote working (roughly, from March 2022 until today)

Mark only one oval per row.

	0 hours	Less than 1 hour	1-2 hours	2-3 hours	3-4 hours	4+ hours
When working on-office	◯	◯	◯	◯	◯	◯
When working remotely	◯	◯	◯	◯	◯	◯

Skip to question 27

Productivity in remote arrangement

18. 13) If you have ever worked on-office, do you feel there is any difference between the productivity achieved when working on-office versus remotely? *

Mark only one oval.

- ◯ I feel that productivity is substantially higher when working remotely
- ◯ I feel that productivity is slightly higher when working remotely
- ◯ I feel there is no difference between productivity when working remotely and on-office
- ◯ I feel that productivity is slightly higher when I work on-office
- ◯ I feel that productivity is substantially higher when I work on-office
- ◯ I have never worked on-office, consequently, I cannot compare

19. 14) What strategies do you use to stay productive when working remotely? **(select all that apply)**

Tick all that apply.

- ☐ Communicate frequently with my teammates
- ☐ Only communicate with my teammates when strictly necessary
- ☐ Defining clear boundaries between work and relaxation
- ☐ Define work periods with regular short breaks
- ☐ Prioritize tasks
- ☐ Having a dedicated and organised workspace
- ☐ Keep my mobile phone away or turn off notifications
- ☐ Dressing similarly to an on-office working day
- ☐ Other: _____

20. 15) When working remotely, do you think you have an adequate workspace that allows you to be productive? *

Mark only one oval.

- ◯ Yes, I believe I have a workspace that is fully equipped and adapted to my needs.
- ◯ Yes, however I feel that my workspace could be improved
- ◯ No, I feel my workspace is inadequate, thus affecting my productivity
- ◯ No, in fact, I don't even have a dedicated workspace, thus affecting my productivity

21. 16) On average, how many extra hours per day are you forced to work beyond your working hours? *

Consider only the time period after the end of mandatory remote working (roughly, from March 2022 until today)

Mark only one oval per row.

	0 hours	Less than 1 hour	1-2 hours	2-3 hours	3-4 hours	4+ hours
When working remotely	◯	◯	◯	◯	◯	◯

22. 17) Since you work remotely, do you feel that you have the same opportunities to be promoted as your colleagues who work on-office? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ I cannot answer, I am not part of a team with on-office members

Skip to question 27

Productivity in on-office arrangement

23. 13) If you have ever worked remotely, do you feel there is any difference between the productivity achieved when working on-office versus remotely? *

Mark only one oval.

- ◯ I feel that productivity is substantially higher when working remotely
- ◯ I feel that productivity is slightly higher when working remotely
- ◯ I feel there is no difference between productivity when working remotely and on-office
- ◯ I feel that productivity is slightly higher when I work on-office
- ◯ I feel that productivity is substantially higher when I work on-office
- ◯ I have never worked remotely, consequently, I cannot compare

24. 14) If you have ever worked remotely, what strategies have you used to stay productive? **(select all that apply)**

If you have never worked remotely, choose not to answer

Tick all that apply.

- ☐ Communicate frequently with my teammates
- ☐ Only communicate with my teammates when strictly necessary
- ☐ Defining clear boundaries between work and relaxation
- ☐ Define work periods with regular short breaks
- ☐ Prioritize tasks
- ☐ Having a dedicated and organised workspace
- ☐ Keep my mobile phone away or turn off notifications
- ☐ Dressing similarly to an on-office working day
- ☐ Other: _____

25. 15) On average, how many extra hours per day are you forced to work beyond your working hours? *

Consider only the period of time after the end of mandatory remote working (roughly, from March 2022 until today)

Mark only one oval per row.

	0 hours	Less than 1 hour	1-2 hours	2-3 hours	3-4 hours	4+ hours
When working on-office	◯	◯	◯	◯	◯	◯

26. 16) Do you feel that team spirit would be strengthened if your whole team worked on-office? *

Mark only one oval.

- I feel that team spirit would be substantially strengthened
- I feel that team spirit would be slightly strengthened
- I feel it would have no impact
- I feel that team spirit would be slightly weakened
- I feel that team spirit would be substantially weakened
- I cannot answer, all my colleagues work on-office too

Skip to question 27

Improvements

Please note that depending on the answer to question 9), it is possible that the numbering does not match that of the last question.

27. 18) Do you feel that the existence of remote workers has any impact on the dynamics and collaboration between team members? *

Mark only one oval.

- I feel that there is a substantial negative impact due to remote working
- I feel there is a slight negative impact due to remote working
- I feel that there is no difference in the dynamics and collaboration of my team due to remote working
- I feel there is a slight positive impact due to remote working
- I feel that there is a substantial positive impact due to remote working
- I can't answer, I've never been part of a team composed of on-office and remote workers (in hybrid mode or not)

28. 19) Do you think that remote workers are well-integrated into team meetings and dynamics? *

Mark only one oval.

- Yes, I have always felt that they are adequately integrated
- Yes, however at some points I felt they could have been better integrated
- No, I often felt that they are not adequately integrated.
- No, I feel that remote workers are totally out of place with the rest of the team.
- I can't answer, I've never been part of a team composed of on-site and remote workers (in hybrid mode or not)

29. 20) Do you think that your employer should promote more activities or informal conversations to foster team spirit (particularly with those working remotely)? *

Mark only one oval.

- Yes, it would help me connect with colleagues I don't know outside of work
- Yes, however, I feel there is a healthy team spirit already
- No, I feel that enough activities are already scheduled for this purpose
- No, I feel such activities to be a waste of time

30. 21) Do you think that simple questions that would be answered promptly in on-office mode require, when working remotely, meetings or prolonged waits for answers, thus hindering productivity? *

Mark only one oval.

- ◯ Yes, my productivity is hindered by the difficulties of remote communication
- ◯ Communication can be equally effective whether it is done in person or remotely
- ◯ No, on the contrary, I feel that communication is more effective when remote
- ◯ I cannot answer, I have never been part of a team with remote workers (in hybrid mode or not)

31. 22) Which strategies have your team adopted to improve the adoption of remote working, and what additional suggestions do you have to improve it even further?

(e.g., to address potential challenges related to communication, personal motivation, productivity, team collaboration, leadership...)

Please indicate which measures were already adopted and which are suggestions

32. 23) Which of the following working arrangements do you prefer? (you can choose an arrangement you have never had the opportunity to experience before) *

Mark only one oval.

- ◯ Fully on-site *Skip to question 33*
- ◯ Hybrid (3 or 4 days on-site) *Skip to question 35*
- ◯ Hybrid (1 or 2 days on-site) *Skip to question 35*
- ◯ Fully remotely *Skip to question 37*

On-site Arregenment

33. 24) What are the main factors that justify your preference for the fully on-site arrangement? *

34. 25) In a scenario where you were looking for new challenges, and you had in your hands two job offers with similar conditions, one enabling on-office work and the other not, would you give priority to the first one? *

Mark only one oval.

- ◯ Yes, in fact, I would decline any offer prohibiting on-office work
- ◯ Yes, however, I could consider the proposal prohibiting on-office work, if it offers better conditions
- ◯ No

Hybrid Arregenment

35. 24) What are the main factors that justify your preference for the hybrid arrangement? *

36. 25) In a scenario where you were looking for new challenges, and you had in your hands two job offers with similar conditions, one enabling remote work and the other not, would you give priority to the first one? *

Mark only one oval.

- ◯ Yes, in fact, I would decline any offer prohibiting remote work
- ◯ Yes, however, I could consider the proposal prohibiting remote work, if it offers better conditions
- ◯ No

Remote Arregenment

37. 24) What are the main factors that justify your preference for the fully remote arrangement? *

38. 25) In a scenario where you were looking for new challenges, and you had in your hands two job offers with similar conditions, one enabling remote work and the other not, would you give priority to the first one? *

Mark only one oval.

- ◯ Yes, in fact, I would decline any offer prohibiting remote work
- ◯ Yes, however, I could consider the proposal prohibiting remote work, if it offers better conditions
- ◯ No