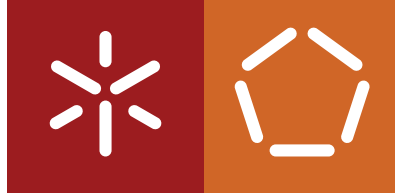


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School of Engineering
Department of Informatics

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

June 2022



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Master dissertation
Integrated Master's in Informatics Engineering

Dissertation supervised by
Professor Doutor João Miguel Lobo Fernandes

June 2022

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Thank you.

Yours sincerely,
Ana Almeida

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.

ABSTRACT

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

COVID-19, a devastating virus that has been more and more controversial, fickle and problematic worldwide. This pandemic brought multiple changes and restrictions to the way we live, rather like a historical buoyed period before and after Christ, translating, nowadays, into before and after COVID-19.

This pandemic forced the worldwide population to be subjected to some lockdown periods, and Portugal was not an exception, in which the population could only leave their home for exceptional and essential situations. From those restrictions, a “new” way of work that has gained more and more popularity was born - the remote work or commonly known as work from home. Thus, it becomes pressing to investigate which are the impacts of this profound change to remote work, in multiple domains (personal, professional,...).

In short, the primordial objective of this dissertation is to study the impact of the referred change to remote work, due to the COVID-19 pandemic, on software professionals in Portugal.

Throughout this dissertation, all the objectives and study questions, along with the relevant state of the art on the theme are exposed. The construction and propagation of the chosen method (survey), the results arising from the collection and treatment of data originated from this survey, along with their analysis, conclusions, limitations and advantages are also highlighted.

In total, 176 valid answers were collected from software professionals from Portugal (mainly from Braga). After the performed statistical analysis on the targeted population and focusing on the 10 elaborated research questions, one can conclude with certainty two major findings: (i) having worked in a remote regimen before the pandemic period has a strong relation with a higher frequency use of teleconference tools (Microsoft Teams, Skype, Zoom,...) after this period, and (ii) participants who do not feel safe about coming back to a fully on-site regimen are more likely to prefer a fully remote regimen than the ones who feel safe and the latter group is more likely to prefer a hybrid regimen. Additionally, although not statistically significant and therefore without certainty, one can also imply that, p.e, (i) having dependants and someone’s support in their care could possibly negatively affect participants’ work; (ii) having dependants could possibly show a relation to a preference for a mainly on-site hybrid regimen, and (iii) company employee dimension could show a relation to participants’ feel of support to maintain productivity. In conclusion, this project has a strong pioneer investigation profile in Portugal, with an applicability in the software engineering area.

KEYWORDS : COVID-19, pandemic, remote work, software engineering, survey.

RESUMO

Análise do impacto do teletrabalho em profissionais de software portugueses durante a pandemia de COVID-19

COVID-19, um vírus devastador que tem sido cada vez mais polémico, inconstante e problematizado a nível mundial. Esta pandemia trouxe inúmeras mudanças e restrições à forma como vivemos, assemelhando-se, de certa forma, a um período histórico balizado antes e depois de Cristo, traduzindo-se, na atualidade, por antes e depois da COVID-19.

Esta pandemia obrigou a que, por todo o mundo, a população fosse sujeita a períodos de confinamento, não sendo Portugal uma exceção, em que a população apenas podia sair de casa para situações excecionais e essenciais. Dessas restrições nasceu uma “nova” forma de trabalho que tem ganho cada vez mais popularidade - o trabalho remoto ou, comumente designado, teletrabalho. Assim, torna-se premente investigar quais os impactos desta profunda mudança para um contexto de teletrabalho, em múltiplos domínios (pessoal, profissional,...).

Posto isto, esta dissertação tem como objetivo primordial estudar o impacto da referida mudança para teletrabalho, resultante da pandemia de COVID-19, em profissionais de *software* em Portugal.

Ao longo desta dissertação, são expostos todos os objetivos e questões de estudo, juntamente com o estado de arte relevante na temática. É evidenciada, igualmente, a construção e divulgação do método escolhido (inquérito), os resultados inerentes à recolha e tratamento dos dados obtidos no inquérito, bem como a sua análise, conclusões, limitações e vantagens.

No total, foram recolhidas 176 respostas válidas de profissionais de *software* de Portugal (maioritariamente, de Braga). Após a análise estatística efetuada na população alvo e focando-se nas 10 questões de estudo elaboradas, é possível concluir com certeza dois principais achados: (i) ter trabalhado em regime remoto antes do período pandémico tem uma relação forte com uma maior frequência de uso de ferramentas de teleconferência (*Microsoft Teams, Skype, Zoom,...*) após esse período, e (ii) os inquiridos que não se sentem seguros em regressar a um regime totalmente presencial têm maior probabilidade de preferir um regime totalmente remoto do que aqueles que se sentem seguros e o último grupo tem maior probabilidade de preferir um regime híbrido. Adicionalmente, embora não estatisticamente significativo e, por consequência, sem certeza, pode-se sugerir que, por exemplo, (i) ter dependentes e apoio de alguém no seu cuidado pode afetar negativamente o trabalho dos inquiridos; (ii) ter dependentes pode evidenciar uma relação com uma preferência por um regime híbrido maioritariamente presencial, e (iii) a dimensão de trabalhadores da empresa pode evidenciar uma relação com a sensação de apoio dos inquiridos para manterem a produtividade.

Em suma, este projeto tem um forte perfil de investigação pioneira em Portugal, com aplicação na área da engenharia de *software*.

PALAVRAS-CHAVE : COVID-19, pandemia, teletrabalho, engenharia de *software*, inquérito.

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ACRONYMS

COVID-19 Coronavirus Disease 2019

n Case number

RQ Research Question

SDK Software Development Kit

SOTA State Of The Art

ϕ *Phi*, i.e., *effect size* measure of χ^2 test

ϕ_c Cramér's *V*, i.e., *effect size* measure of χ^2 test

χ^2 Chi-squared test

Part I

INTRODUCTORY MATERIAL

INTRODUCTION

In December 2019, the first cases of pneumoniae of unknown cause were identified in the province of Wuhan, China. Epidemiological and etiological investigations on this cluster of patients led to the identification, in January 2020, of a novel coronavirus capable of causing Severe Acute Respiratory Syndromes (SARS), having been named SARS-CoV-2 [1, 2]. The rapid worldwide dissemination of this disease, known as COVID-19, led to its declaration as a pandemic by the World Health Organization in March 2020 [3]. The Portuguese government proceeded to the implementation of a state of emergency and, since this declaration, Portugal has registered over 3 million cases of COVID-19 and over 21000 deaths [4]. All this situation, caused the world to suffer profound adaptations in multiple domains - work, home, social, economical, among others.

Hereupon, this dissertation intends to study some of these domains, especially in the remote work field, and understand its impact in multiple strands.

1.1 OVERVIEW AND MOTIVATION

Remote work is a type of flexible working arrangement that allows an employee to work from a remote location outside of corporate offices [5]. This concept dates back to the 70's when the world worried about their oil and the impact that home-work dislocations had on their reservoirs. In that same decade, in 1973, NASA engineer Jack Nilles laid the foundation for modern remote work when he invented the term "telecommuting" [6]. However, even before that, in 1857, J. Edgar Thomson, president of the "Pennsylvania Railroad", controlled his railroad track through a private telegraph, which allowed him to manage his resources and workers "remotely" [7]. In this century, remote work was somewhat used, often through a Wi-Fi equipped laptop or tablet or even a smartphone, to work from home, public libraries, coffee shops or others.

As aforesaid, COVID-19 brought a wide range of symptoms and a high mortality rate worldwide, which caused multiple world leaders to decide to lockdown their population for several months. Even after that measure was eased and since many restrictions were still mandatory, some companies decided to embrace the remote work completely.

Therefore, in this dissertation, it is intended to analyze and understand the impact that the change to remote work, due to the COVID-19 pandemic (December 2019 - present), caused (and still causes) to software professionals. Since this thematic is somewhat extensive, only some parameters (such as dependants, home-work dislocations, productivity, among others) were chosen for this project.

1.2 SCHEDULE

- **Problem study**, through research on the theme, as a preparation method;
- **Analysis and reading of indicated articles/bibliography** of pre-existing studies on the theme;
- **Conduct a survey** on software professionals from multiple Portuguese companies, in order to obtain the needed data;
- **Collecting and Preparing data** aforesaid, for posterior analysis/treatment;
- **Data analysis and treatment** aforementioned, in order to build all the necessary (statistical) analysis to the present dissertation;
- **Dissertation's writing.**

	2021			2022					
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Problem Study									
Analysis and reading of indicated articles/bibliography									
Conduct a survey									
Collecting and Preparing data									
Data analysis and treatment									
Dissertation's writing									

Table 1: Schedule for the dissertation

1.3 DISSERTATION'S STRUCTURE

This document consists of several chapters with the following content:

- *Introduction* (already presented): where the nature of the problem in question was described, along with its overview, motivation and a general project timeline;
- *State Of The Art*: where the overview of several articles and literature is presented, particularly the flowed approach and the obtained results;
- *Steps to study the impact of COVID-19 on software professionals*: where the chosen approach is discussed, the results and experiments are explained and the study's limitations and advantages are presented;
- *Conclusions and Future Work*: where a brief overview of the work done is made, along with a recapitulation of the conclusions drawn on the statistical analysis and a comparison with some findings on pre-existent literature, ending with what can possibly be achieved in the future.

STATE OF THE ART

This chapter presents an overview (both written and summarized on tables) on the articles considered most important on this theme, including a brief description of the problem, the analyzed population, the used methodology and the obtained results. It also contains a section regarding the survey preparation of this study.

2.1 ARTICLES OVERVIEW

2.1.1 *“Pandemic programming. How COVID-19 affects software developers and how their organizations can help”*

RALPH et al. aim to study and understand the effects on software developers' emotional wellbeing and productivity while working from home during the **COVID-19** pandemic. For that purpose, they used a mostly “built from scratch” survey, translated into 12 languages. This large-scale cross-sectional study used 2225 worldwide software developers, from 53 countries, that were working remotely during the **COVID-19** lockdown, surveying five variables.

In general, the main conclusions are: (i) the theoretical model is confirmed, i.e., software developers who are working from home during the pandemic are suffering with diminished emotional wellbeing and productivity; (ii) emotional wellbeing and productivity are tightly related; and (iii) poor disaster preparedness, fear related to the pandemic, and poor home office ergonomics affect (negatively) wellbeing and productivity. Lastly, an exploratory analysis suggests that women, parents and people with disabilities may be disproportionately affected, therefore the standardization of aid measures is not globally helpful, since different people need different kinds of support.

2.1.2 *“How does Working from Home Affect Developer Productivity? - A Case Study of Baidu During COVID-19 Pandemic”*

BAO et al. intend to comprehend whether working remotely affected the “Baidu Inc” workers' productivity. For that purpose, they used a quantitative analysis (utilizing mix-methods) on a dataset to collect, approximately, 4000 records of 139 developers' activities of 138 working days. Since only 1103 of those records were submitted when developers were actually working from home due to the **COVID-19** pandemic, solely the referred 1103 records were considered.

In all the results, different metrics (such as number of builds, commits, and inserted/deleted lines) were used. The results obtained suggest that, overall, working remotely has different impacts (whether negative or positive) on developers' productivity and that the productivity of the majority of working from home developers is similar to that when working on-site. In short, the main conclusion is that productivity depends on the project's characteristics (such as programming language and project's type/age/size). The average productivity does not change while working from home, nevertheless, to some developers, it is very beneficial and, to others, it is very detrimental.

2.1.3 *"The Daily Life of Software Engineers during the COVID-19 Pandemic"*

RUSSO et al. propose to investigate how a normal working day looks like (when comparing working remotely and on-site) and how certain activities affect software developers' wellbeing and productivity. For that purpose, they performed a two-wave longitudinal study¹, which involved 192 worldwide selected software professionals, but living in countries with comparable COVID-19 lockdown measures, analyzing the aforesaid daily activities with perceived wellbeing, productivity and other relevant variables, adding up to 51.

The results indicate that time distribution of working activities pre and during the pandemic is very similar. However, the aforesaid time distribution is not related to workers' wellbeing, perceived productivity and other variables. In short, (i) wellbeing and productivity are related; (ii) workers adapt to their work condition with time, improving said wellbeing and productivity, and (iii) working in a remote regimen is not a challenge itself for organizations or software developers.

2.1.4 *"Predictors of well-being and productivity among software professionals during the COVID-19 pandemic – a longitudinal study"*

RUSSO et al. conducted an investigation on the impact of the COVID-19 pandemic lockdown restrictions on software engineers who were working from home. For this, they used a two-wave longitudinal study on 192 software workers, covering over 50 factors that have previously been associated with wellbeing or productivity, such as anxiety, distractions, stress, work motivation, among others.

The analyzed results suggest that (i) stress predicts an individual's wellbeing negatively; (ii) productivity was less strongly associated with all predictor variables, hinting that software engineers adapted to the lockdown situation over time with their wellbeing actually increasing, and (iii) no predictor variable was significantly able to causally explain the variance in wellbeing and productivity. Interestingly, they also discovered that introverts are disproportionately affected by the lockdown. Overall, one can conclude that remote work *per se* was not a challenge for the analyzed population.

¹ I.e., a study that takes place over time, with two waves of measurement in a longitudinal design.

2.1.5 *“Understanding Developers Well-Being and Productivity: A Longitudinal Analysis of the COVID-19 Pandemic”*

RUSSO et al. explored the progression of remote work during the pandemic by analyzing 15 psychological, social and situational variables across a four-wave longitudinal study for over 14 months. Another proposed objective was to test whether there were changes in any of the referred variables across time. All 192 participants lived in countries with comparable lockdown policies, to ensure a fair analysis.

In short, the drawn conclusions are: (i) developers' wellbeing increased; (ii) productivity remained unchanged; (iii) developers felt less lonely and improved their social contacts; (iv) stress decreases wellbeing levels; (v) self-blame increased; (vi) men and women are similar across all measured variables, and (vii) no difference between countries was found when dealing with the pandemic.

2.1.6 *“A Tale of Two Cities: Software Developers Working from Home during the COVID-19 Pandemic”*

FORD et al. studied how developers and their productivity were affected by the change to remote work due to COVID-19 pandemic. In order to perform said study, two surveys, with a combined total of 3634 valid answers, were conducted weeks apart in order to understand the advantages, limitations and opportunities to improve the referred remote work.

The presented results show that the impact on developers is somewhat even (explaining the title “Two Cities”), p.e., for some being close to family members was beneficial while for others having said family members share their working space and interrupting their focus was a challenge. The main divergent factors are: (i) ability to focus; (ii) work autonomy and motivation; (iii) work environment; (iv) meetings; (v) work–life balance; (vi) childcare needs, and (vii) social connections.

2.1.7 *“Gendered Experiences of Software Engineers During the COVID-19 Crisis”*

MACHADO et al. research focuses on possible differences that gender causes on the fully remote work occasioned by COVID-19. An online 31-question survey conducted in Brazil for a five week period was used to analyze this theme, with a total of 366 valid answers.

The reported findings reveal that the female gender faces specific challenges, as they lack support with housework and have to take care of their children. Interestingly, another conclusion states that most strategies adopted by organizations to facilitate working from home addressed male concerns, but not female's.

2.1.8 *“How Human and Organizational Factors Influence Software Teams Productivity in COVID-19 Pandemic: A Brazilian Survey”*

Also in Brazil, BEZERRA et al. conducted a survey, through a 19-day period, on 58 IT professionals from software teams in order to analyze how environmental factors (such as work environment, collaboration and organization of

teams, motivation, among others) can influence productivity in remote work during the [COVID-19](#) pandemic. For the majority of participants, productivity did not suffer a negative impact and they continued to be motivated and able to easily communicate with their coworkers. Additionally, work skill and experience of the software team were found to have a strong relationship and experience is a key factor for teams' productivity. Despite the considered positive impacts, a little less than half the participants did not receive any kind of assistance from their company to work remotely.

2.1.9 *"Remote workers' wellbeing in the age of [COVID-19](#)"*

Continuing on the aforementioned country, [CALDEIRA et al.](#) discuss the results of a survey study, conducted over a 5-week period, on the impact of remote work during the [COVID-19](#) pandemic, particularly on 366 Brazilian workers' wellbeing.

Analyzing the presented results, one can conclude that the main factors influencing workers' wellbeing are common ground challenges, collaboration readiness, collaboration technology readiness, organizational management and interruptions. Furthermore, organizational incentives used to improve engagement among coworkers are also associated with workers' wellbeing.

2.1.10 *"Working From Home During a Pandemic - Investigation of the Impact of [COVID-19](#) on Employee Health and Productivity"*

[GULER et al.](#) aim to investigate ergonomic problems (such as back pain, resting, among others) and employee productivity while working from home during the [COVID-19](#) pandemic. This cross-sectional study was conducted on 194 office workers who switched to remote work during the pandemic through an online 57-question survey. As can be somewhat expected, a significant increase in back pain was revealed, since participants spent more hours sited on the computer with bad posture, which reveals a declining route in employee health. However, participants actually reported an increase in productivity, since they claimed to be more relaxed, more efficient and able to provide a better quality of work.

2.1.11 *"Exploring the Impact of Mandatory Remote Work during the [COVID-19](#) Pandemic"*

[OZ and CROOKS](#) concentrated on analyzing the consequences on organizational company communication due to the forced change to remote work. In order to do so, five months of calendar and messaging metadata from 35 workers of two offices of a technology company were investigated.

Research found that communication between different teams increased more than within them, while, for the latter, messaging increased considerably, but meeting frequency stayed the same. In particular, the number of short meetings increased while long meetings decreased. As can be expected to some extent, extra work-hour messaging became much more frequent, even though employees tend to respond to non-managers faster than to managers.

2.1.12 *“How Was Your Weekend?” Software Development Teams Working From Home During COVID-19*”

MILLER et al. intend to investigate whether team culture and team productivity were affected due to change to remote work during the pandemic. For that, two surveys were conducted at a large software company. The first survey, an exploratory one, showed that, in the analyzed 2265 developer answers, many of them faced challenges reaching milestones and their team productivity changed along with other important team culture factors, such as communication and social connection. The second survey used data that emerged from the first one in order to understand the prevalence of the reported changes. Out of 608 developer answers, one can conclude that the majority missed social interactions with colleagues and felt a decrease in their communication ease. In short, ability to brainstorm with colleagues, difficulty communicating with them and satisfaction with interactions from social activities are key factors that are associated with how software development teams report their productivity.

2.1.13 *“Challenges and Gratitude: A Diary Study of Software Engineers Working From Home During COVID-19 Pandemic*”

BUTLER and JAFFE examined the experience with working remotely of 435 employees from a major software department of Microsoft regarding the immediate period after the pandemic lockdown. Anonymous nightly diary answers over the first 10 weeks of the referred period were collected from each participant. In general, the greatest downsides employees faced were having too many meetings and feeling overworked. On the other hand, most were thankful to have their families support and increased flexibility. Lastly and since this is a nightly study, an interesting conclusion is the fact that reflecting nightly actually helped participants to feel satisfied with that day.

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

ŠMITE et al. purpose was to comprehend the perceived changes in productivity when comparing on-site work before the pandemic with remote work during the pandemic. For that, data was analyzed from two sources: (i) six corporate surveys conducted in four Scandinavian companies, and (ii) seven other surveys that already existed in literature, to supplement the perceived productivity data. In addition, an explanation for the variation in perceived productivity was searched among the analyzed population. Findings on the 7686 data points indicate that, on average, perceived productivity has not changed significantly, in fact there are developers who report being more productive and others less productive when working remotely. The first group mentioned feeling the benefits of a better work organization, increased flexibility and focus. However, the second group complained about the challenges related to distanced teamwork and collaboration, as well as emotional issues, distractions and poor home office environment and equipment. This study has a very particular conclusion which revealed that developers' productivity in the later months of the pandemic showed better results

than those in the earlier months, which is consistent with the fact that workers tend to adapt to their situation over time.

2.1.15 *“From Forced Working-From-Home to Working-From-Anywhere: Two Revolutions in Telework”*

ŠMITE et al. has a more broadened approach than some of the other presented articles since the used methodology consists of monitoring the situation of an international software company with engineers located in multiple countries (such as Sweden, USA and the UK). Mix-methods were used to collect data that focused on productivity, developers' satisfaction and wellbeing, activity, communication and collaboration, efficiency and flow based on the archives of committed data, calendar invites, Slack communication and internal reports of remote experiences. This was complemented with 18 semi-structured interviews on 15 engineers and three managers.

The followed approach revealed that company engineers continued to commit code and carried out their daily duties without significant disruptions, with their routines gradually adjusting to the new reality. In general, it seems that software companies can work remotely with no significant impact on various aspects of productivity.

2.1.16 *“Work-from-home and its implication for project management, resilience and innovation - a global survey on software companies”*

NGUYEN-DUC et al. main objective is to investigate how remote work impacts software projects and companies, in particular, if it differs between software startups and established companies. This global-scale, cross-sectional survey study was conducted during spring and summer of 2021 and the methodology followed both quantitative and qualitative analysis of 297 valid responses.

Team partnership, agility and leadership were found to be the three most important factors for achieving resilience during the pandemic. Peculiarly, startups appeared not to perceive the impact of remote work differently. Furthermore, one can affirm that many challenges of remote work can be overcome by looking “inside” each team and adopting leadership, management and coordination mechanisms.

2.1.17 *“Challenges of Working From Home in Persistent COVID-19 Environment”*

P.M and P provided a study that proposes to identify both the challenges of remote work and the changes in aforesaid challenges in the persistent COVID-19 environment. Therefore, this study's objective is to identify and analyze the challenges of remote work faced by 107 Indian IT employees during the pandemic and to assess whether there are any changes between the beginning and during the pandemic in said challenges. To achieve this, an exploratory study was conducted over the course of one month, which involved data collection through a well-structured questionnaire and from pre-published sources (such as books or journals).

Based on the presented results, one can conclude that, from all the analyzed variables, only seven of them (i.e., scheduling time to work and family, more time taken to finish work, lack of infrastructures at home, increased mental stress, fear of job loss, lack of supervisory support from higher authority and lack of face to face interaction)

are considered as a higher level of challenges. Lastly, a significant difference between the challenges faced by married and unmarried employees and employees with different educational background was discovered.

2.1.18 *“Software professionals during the COVID-19 pandemic in Turkey: Factors affecting their mental well-being and work engagement in the home-based work setting”*

TOKDEMIR aims to explore Turkish software professionals' mental wellbeing and work engagement and how these variables relate with job strain and resource-related factors in the remote work regimen set during the COVID-19 pandemic. This cross-sectional study, based on well-known and validated scales, was conducted on 321 participants over the course of one month through an online survey.

The drawn conclusions indicate that, regardless of the negative effect of job strain, sleep quality, decision latitude, work-life balance and exercise predict mental wellbeing. Work engagement is predicted by job strain, sleep quality and decision latitude. The presented findings also suggest that allowing greater autonomy and enhancing the quality of sleep mitigates the negative effects on software professionals' mental wellbeing and work engagement.

2.1.19 *“Impact on the Productivity of Remotely Working IT Professionals of Bangladesh during the Coronavirus Disease 2019”*

GANGULY et al. have a slightly different study objective when comparing to all previous articles - it is not only intended to study the remote work impact on Bangladeshis professionals' productivity, but also to debate on whether remote work can be continued after lockdown measures are ceased. In order to do so, an anonymous survey was designed, refined (after a first pilot test) and conducted to collect data from 1062 workers throughout a month. A descriptive analysis was performed on said data to discover patterns and relationships among the 24 studied factors.

As such, data revealed that remote work had a negative impact on six (i.e, quality of internet connection, hardware accessibility, frequency of household chores, workplace suitability, frequency of interruptions and cheerfulness of employees) out of the 24 aforementioned productivity related factors. From graph analysis, one can also conclude that team cooperation, activity level, well-defined goals, number of task assignments, feedback of work and frequency of communication were the most influential factors positively impacting productivity. On the other hand, participants' resource accessibility, work environment and emotional wellbeing during remote work have resulted in a negative impact on productivity.

2.1.20 Survey

To help with the questionnaire (and survey) preparation, a section of the book from [FERNANDES and MACHADO](#) that explains the use of surveys and the steps necessary to apply them² was used. A survey is a technique that uses a questionnaire to collect information on multiple domains (grouped in several sets of questions) from a high number of respondents. The same questionnaire used for all those respondents will allow to statistically handle the collected answers, but, if the questions are not focused in what we want to study or if they are formulated in an unclear way, the answers might not be relevant to the study and ruin the analysis.

Some important recommendations are:

- making sure that terms and concepts of the theme are well known to the participants (one should write an instruction set in the begging of the survey);
- the questionnaire must be well written, without errors or wrong punctuation;
- the questionnaire should be focused, avoiding irrelevant information from being collected;
- only a single question must be asked at the time;
- the answers should include all possible alternatives (or a “other”, where participants can write their own);
- avoid the use of negative questions, always making it simple to answer “yes” or “no”.

One important advantage of surveys over some other mechanisms is that they do not demand too much effort from those that answer the questions (if questions are well built, most of the time, the answer is simply “yes” or “no”), which can lead to having a larger number of participants. On the other hand, surveys are limited, since we have to believe that participants answered truthfully, risking to get answers that do not reflect what individuals really think.

2.2 DISCUSSION AND ANALYSIS

From analyzing the [SOTA](#) one can conclude that there is an abundance of different approaches, but the results are somewhat similar - overall, software developers that worked remotely during the pandemic period did not suffer the severe negative impact many would expect.

Also, companies should work on strategies to help their employees, however those must be done for each and every single one of them individually, since different people have different needs.

Since the root of the problem is the same (i.e., working remotely during and due to the [COVID-19](#) pandemic), one can conclude that a survey is a proper way of obtaining answers for a statistical analysis on different domains.

To summarize, some overview tables for all the present articles can be seen below:

² Further note on this steps will be discussed in section [3.1](#).

Year	Article	Sample size	Methodology
2020	RALPH et al. [8]	2225 workers	Large-scale (global) cross-sectional study of remote work impact, surveying five variables
	BAO et al. [9]	139 workers	Mixed-methods study at “Baidu Inc” in China to investigate productivity while working from home
	BEZERRA et al. [15]	58 workers	Survey conducted in Brazil to analyze how environmental factors can influence productivity
	OZ and CROOKS [18]	35 workers	Metadata (calendar, messaging, etc) exploit on two offices from the same company
	GANGULY et al. [26]	1062 workers	Survey conducted in Bangladesh to study remote work viability, analyzing 24 factors
2021	RUSSO et al. [10]	192 workers	Two-wave longitudinal study in countries with comparable COVID-19 lock-down measures, surveying 51 variables
	RUSSO et al. [11]	192 workers	Two-wave longitudinal study in countries with comparable COVID-19 lock-down measures, surveying 51 variables
	RUSSO et al. [12]	192 workers	Four-wave longitudinal study in countries with comparable COVID-19 lock-down measures, analyzing 15 variables
	MACHADO et al. [14]	366 workers	Online survey conducted in Brazil to study possible gender differences on the fully remote regimen
	CALDEIRA et al. [16]	366 workers	Survey conducted in Brazil to analyze remote work pre and during the pandemic
	GULER et al. [17]	194 workers	Cross-sectional study of an online survey on ergonomic problems and productivity
	MILLER et al. [19]	2265 workers	Large-scale study of a survey conducted on a large software company
	BUTLER and JAFFE [20]	435 workers	Nightly diary answer collection to study the experience of remote work on Microsoft
	ŠMITE et al. [22]	18 workers	Large-scale mixed-methods study at Sweden, USA and the UK that includes semi-structured interviews
P.M and P [24]	107 workers	Exploratory study with data collection from a survey and pre-published public sources	
2022	FORD et al. [13]	3634 workers	Two survey collection of qualitative and quantitative insights on remote work
	ŠMITE et al. [21]	7686 workers	Data analysis of surveys conducted on four Scandinavian companies and of other pre-existing surveys
	NGUYEN-DUC et al. [23]	297 workers	Large-scale (global) cross-sectional study of quantitative and qualitative insights on remote work on companies
	TOKDEMIR [25]	321 workers	Cross-sectional study of an online survey conducted in Turkey, based on well-known and validated scales

Table 2: Overview of target population and methodology from the presented articles about change to remote work during the pandemic and its impact

Year	Article	Findings
2020	RALPH et al. [8]	<ul style="list-style-type: none"> ● diminished emotional wellbeing and productivity; ● emotional wellbeing and productivity are tightly related; ● poor disaster preparedness, fear related to the pandemic, and poor home office ergonomics affect negatively wellbeing and productivity.
	BAO et al. [9]	<ul style="list-style-type: none"> ● remote work has different impacts (whether negative or positive) on productivity; ● productivity in remote work is mainly similar to on-site work; ● productivity depends on project's characteristics.
	BEZERRA et al. [15]	<ul style="list-style-type: none"> ● for the majority, productivity did not suffer a negative impact; ● motivation and ability to easily communicate with coworkers persisted; ● work skill and experience of the software team have a strong relationship; ● experience is a key factor for teams' productivity; ● little less than half the participants did not receive any kind of assistance from their company to work remotely.
	OZ and CROOKS [18]	<ul style="list-style-type: none"> ● communication between different teams increased more than within them; ● messaging within teams increased considerably, while meeting frequency stayed the same; ● the number of short meetings increased while long meetings decreased; ● extra work-hour messaging became much more frequent.
	GANGULY et al. [26]	<ul style="list-style-type: none"> ● remote work has a negative impact on quality of internet connection, hardware accessibility, frequency of household chores, workplace suitability, frequency of interruptions and cheerfulness of employees; ● team cooperation, activity level, well-defined goals, number of task assignments, feedback of work and frequency of communication are the most influential factors positively impacting productivity; ● participants' resource accessibility, work environment and emotional wellbeing result in a negative impact on productivity.

(a) Overview of findings from 2020 articles

Year	Article	Findings
2021	<p>RUSSO et al. [10]</p>	<ul style="list-style-type: none"> ● time distribution of working activities pre and during the pandemic is very similar; ● time distribution is not related to wellbeing, perceived productivity and other variables; ● wellbeing and productivity are related; ● workers adapt to their work condition with time, improving wellbeing and productivity; ● working in a remote regimen is not a challenge itself.
	<p>RUSSO et al. [11]</p>	<ul style="list-style-type: none"> ● stress impacts wellbeing negatively; ● productivity is less strongly associated with all predictor variables, suggesting that workers adapt to their situation over time; ● no predictor variable was significantly able to causally explain the variance in wellbeing and productivity; ● introverts are disproportionately affected by the lockdown; ● working in a remote regimen is not a challenge itself.
	<p>RUSSO et al. [12]</p>	<ul style="list-style-type: none"> ● developers' wellbeing increased; ● productivity remained unchanged; ● developers felt less lonely and improved their social contacts; ● stress decreases wellbeing levels; ● self-blame increased; ● men and women are similar across all measured variables; ● no difference between countries was found.
	<p>MACHADO et al. [14]</p>	<ul style="list-style-type: none"> ● women lack support with housework and have to take care of their children; ● most strategies adopted by organizations to facilitate remote work are addressed for male concerns, but not female's.
	<p>CALDEIRA et al. [16]</p>	<ul style="list-style-type: none"> ● the main factors influencing workers' wellbeing are common ground challenges, collaboration readiness, collaboration technology readiness, organizational management and interruptions; ● organizational incentives are also associated with workers' wellbeing.
	<p>GULER et al. [17]</p>	<ul style="list-style-type: none"> ● back pain increased significantly, revealing a decrease in employee health; ● productivity increased, since employees are more relaxed, more efficient and able to provide a better quality of work.
	<p>MILLER et al. [19]</p>	<ul style="list-style-type: none"> ● reaching milestones was challenging; ● team productivity changed, along with other important team culture factors; ● the majority misses social interactions with colleagues and feels a decrease in their communication ease; ● ability to brainstorm with colleagues, difficulty communicating with them and satisfaction with interactions from social activities are key factors associated with how software development teams report their productivity.
	<p>BUTLER and JAFFE [20]</p>	<ul style="list-style-type: none"> ● workers struggled with having too many meetings and feeling overworked; ● most were thankful to have their families support and increased flexibility; ● reflecting nightly helped participants to feel satisfied with that day.

Year	Article	Findings
2021	ŠMITE et al. [22]	<ul style="list-style-type: none"> engineers continued to commit code and carried out their daily duties without significant disruptions; workers adapt to their work condition with time.
	P.M and P [24]	<ul style="list-style-type: none"> scheduling time to work and family, more time taken to finish work, lack of infrastructures at home, increased mental stress, fear of job loss, lack of supervisory support from higher authority and lack of face to face interaction are considered as a higher level of challenges; challenges faced by married and unmarried employees and employees with different educational background are significantly different.

(b) Overview of findings from 2021 articles

Year	Article	Findings
2022	FORD et al. [13]	<ul style="list-style-type: none"> proximity to family members is beneficial for some and challenging for others; ability to focus, work autonomy and motivation, work environment, meetings, work–life balance, childcare needs and social connections are the main divergent factors related to productivity.
	ŠMITE et al. [21]	<ul style="list-style-type: none"> perceived productivity did not change significantly; developers who report being more productive feel the benefits of a better work organization, increased flexibility and focus; developers who report being less productive complain about the challenges related to distanced teamwork and collaboration, as well as emotional issues, distractions and poor home office environment and equipment; workers tend to adapt to their situation over time.
	NGUYEN-DUC et al. [23]	<ul style="list-style-type: none"> team partnership, agility and leadership are the most important factors for achieving resilience; startups did not perceive the impact of remote work differently.
	TOKDEMIR [25]	<ul style="list-style-type: none"> job strain has a negative effect; sleep quality, decision latitude, work-life balance and exercise predict mental wellbeing; work engagement is predicted by job strain, sleep quality and decision latitude; allowing greater autonomy and enhancing the quality of sleep mitigates the negative effects on software professionals' mental wellbeing and work engagement.

(c) Overview of findings from 2022 articles

Table 3: Overview of findings from the presented articles about change to remote work during the pandemic and its impact

Part II

CORE OF THE DISSERTATION

STEPS TO STUDY THE IMPACT OF COVID-19 ON SOFTWARE PROFESSIONALS

In order to study the impact of COVID-19 on software professionals and as already explained in chapter 2, it was decided to:

1. build a structured questionnaire with multiple domain analysis;
2. conduct the survey to a significant number of participants from multiple companies in Portugal;
3. handle and treat all the data received and collected;
4. provide a statistical analysis on the aforesaid data;
5. debate on conclusions/results regarding said analysis.

Once the survey is conducted and data collection is completed, the resulting dataset needs to be analyzed and processed. After that, the research questions and the statistical analysis necessary to answer them needs to be elaborated. Thus, this chapter walks through all this process.

3.1 CASE STUDY SETUP

To conduct a good survey, some necessary steps must be followed in order to build and apply it correctly. The referred steps can be seen in the diagram below:

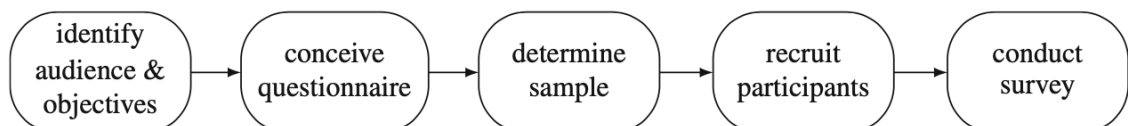


Figure 1: Main steps of the process to apply a survey, extracted from [27] (figure 5.3, p. 97)

3.1.1 *Population and Inclusion Criteria*

This study's target population is software professionals that work in Portugal and switched from an on-site regimen to a remote regimen during the [COVID-19](#) pandemic (December 2019 - present).

The two links for the Portuguese and English versions of the survey were sent to software professionals via email, Instagram and LinkedIn. They were encouraged to share said survey with their colleagues who might also take it. Since the survey is anonymous, an email address was provided so that participants who want to know the study's results can ask to be contacted.

3.1.2 *Objectives*

Main Study Objective

- Study the impact that the change to remote work, due to the [COVID-19](#) pandemic (December 2019 - present), caused (in multiple levels) to software professionals.

Other Study Objectives

- Elaborate a study that brings new data to the theme, instead of fully grounding an investigation on pre-existing papers/articles;
- Obtain the necessary study data through survey sharing with software companies and workers;
- Prepare a full analysis that allows the attainment of relevant conclusions on the multiple analyzed domains.

In short, with this dissertation, it is expected to obtain a full, robust and relevant study on the change to remote work, due to the [COVID-19](#) pandemic, and its impact on Portuguese based software professionals.

3.1.3 *Questionnaire structure*

The questionnaire was originally written in Portuguese, however to not exclude foreign workers, it was translated to English. Both were shared and data was collected from both.

Nowadays, there are multiple platforms that support the conduction of surveys. For this project, the chosen platform was Google Forms, one of the most famous and popular survey platforms.

As mentioned earlier, the questionnaire (and, consequently, the survey) analyzes multiple domains, containing two questions that filter out irrelevant answers:

1. To exclude participants who do not consent that their data is used for academic purposes;
2. To rule out participants who, during the pandemic period (December 2019 - present), did not change from an on-site regimen to a remote regimen.

After these two questions, multiple sections exist, all regarding the pandemic period (December 2019 - present), in order to explore the aforementioned domains:

- *Personal data*: used to characterize the sample, i.e., participants' age group, gender and birth country;
- *Academic and Professional data*: also relevant for sample characterization, i.e., academic background, name of participants' work company and where it is located, job position and main area of said job position;
- *Ascendants/Descendants*: learn if participants have dependants (i.e., elderly or children younger than 12 years old) living with them;
- *Household*: only for participants who have dependants. One must answer about the number of members in their household, the possible negative impact of having to support their dependants and if some household member helped with said support;
- *Caregiver support*: solely for participants who had support from some household member. Participants are asked to write who that person/people was/were and to chose if their company took action (or not) to aid them in their caregiver situation;
- *Aid measures*: if the participant's company took action to aid them in their caregiver situation, then they are asked to write some of those actions/measures;
- *Working Hours*: understand if participants complied with their work hours, without the need to work extra hours;
- *Extra hours*: uniquely for participants that did not respect their work schedule. One is intended to answer how many extra hours they needed to work per day;
- *Commuting to work and housing*: comprehend how much time participants take to dislocate from home-work and work-home and if they had to move to another house;
- *Moving from your house*: solely for participants who moved to another house in order to understand why did they move;
- *Productivity*: learn if participants consider that their productivity varied, if they felt supported by their company to maintain said productivity and if they adopted any strategy to maintain it;
- *Productivity Strategies*: uniquely for participants who adopted strategies, in order to write some of those strategies;
- *Remote regimen*: understand if participants had ever worked in a remote regimen before the pandemic period, which were the two types of internal communication tools that were more frequently used to interact with their team, if the frequency use of type "teleconference tools" was the same before and during the pandemic period, what were the adopted software methodologies and if it was necessary to acquire new equipment/services suitable to the remote regimen;

- *Necessary Equipments*: only for participants who acquired new equipment/services. One is asked to write some of those equipments/services and if any of those were provided by their company;
- *Future work regimen*: comprehend if participants feel safe about coming back (whether it has already happened, or will still happen) to a fully on-site regimen and which is their preference regarding their future work regimen.

This last answer has three options and, depending on the chosen one, it redirects to a different section:

- *Fully On-site regimen*: learn which are the main factors that justify the participants' preference for the on-site regimen;
- *Fully Remote regimen*: understand which are the main factors that justify the participants' preference for the remote regimen;
- *Hybrid regimen*: comprehend which is the participants' preference regarding the hybrid regimen (i.e., mainly on-site, balanced hybrid or mainly remote) and what are the main factors that justify their preference for the hybrid regimen.

In total, the questionnaire has 40 questions and the survey groups them in 20 sections.

3.1.4 Dataset

The results of the collected dataset can be regarded in the table below:

	Date Range	Answers
<i>Portuguese version</i>	2021/12/13 - 2022/05/02	165
<i>English version</i>	2022/02/18 - 2022/05/02	30
TOTAL		195

Table 4: Dataset results' overview

The Portuguese version has an earlier start date, since five answers were collected on the company Accenture and one on the company Bosch to test the questionnaire's accuracy and the survey's viability.

By the end of the answer collecting, the dataset had to be processed since there were two answers from individuals who did not work in Portugal and 17 answers from participants who did not change from an on-site regimen to a remote regimen during the pandemic period. Thus, the valid answer total is **176** (i.e., 90.3% valid answers). To ease the analysis, a Python script was created to automatically translate all the answers from the Portuguese version of the survey to English. Both surveys were then merged, in order to analyze all the answers together.

Regarding the aforementioned **176** valid answers, the frequencies of the data that characterizes the sample are:

Gender		
Female	Male	Other
40	135	1

(a) Frequency of participants' gender

Age group		
18-35	36-50	51-65
127	45	4

(b) Frequency of participants' age group

Country of birth								
Angola	Brazil	Canada	France	Germany	Netherlands	Portugal	South Africa	United States
2	6	1	4	1	1	159	1	1

(c) Frequency of participants' country of birth

Table 5: Frequency of participants' personal data

Academic background				
Bachelor's degree	High School	Masters	PhD	Professional Course
62	2	93	10	9

(a) Frequency of participants' academic background

Place of work	Aveiro	1
	Barcelos	1
	Braga	111
	Bragança	1
	Coimbra	3
	Covilhã	1
	Vila Nova de Famalicão	5
	Vila Nova de Gaia	1
	Guimarães	2
	Lisbon	27
	Maia	2
	Matosinhos	1
	Oeiras	1
	Porto	14
	Póvoa de Varzim	1
	Trofa	1
Vila Verde	3	

(b) Frequency of participants' place of work

Company employee dimension	Small enterprises (10 to 49 employees)	48
	Medium-sized enterprises (50 to 249 employees)	41
	Large enterprises (250 employees or more)	81
	Rather not indicate	6

(c) Frequency of company employee dimension

Job position	Back-End Developer	17
	Business Analyst	2
	Chief Executive Officer (CEO)	7
	Chief Product Officer (CPO)	1
	Chief Technology Officer (CTO)	5
	Cloud Automation Engineer	1
	Commercial	3
	Data Engineer	8
	Data Scientist	3
	Database Administrator	1
	Deep Learning Engineer	1
	DevOps Engineer	5
	Embedded Systems Developer	10
	Engineering Director	1
	Engineering Manager	2
	Full-Stack Developer	26
	Integration Developer	3
	Knowledge Manager	1
	Mobile Developer	3
	Network Engineer	1
	Product Designer	5
	Product Manager	1
	Product Owner	3
	Professional Services Operations Team	1
	Project Manager	14
	Quality Engineer	4
	Quality Manager	1
	Research and Development Director	1
	Researcher	2
	Security Engineer	1
	Senior Consultant	1
	Site Reliability Engineer	1
	Software Engineer	5
	System Administrator	3
	System Analyst	4
	Systems Architect	2
Team Manager	1	
Tech Leader	1	
Technical Consultant	1	
Test Engineer	9	
Web Developer	14	

(d) Frequency of participants' job position

Table 6: Frequency of participants' academic/work data

3.2 RESEARCH QUESTIONS

The elaborated research questions, based on the survey's targeted questions, are:

- RQ1: "Does participants' gender relate to having no support from someone in their household?"
- RQ2: "Do participants who have dependants suffer a negative impact in productivity?"
- RQ3: "Do participants who have dependants and no support from someone in their household are more negatively affected at work than those who do?"
- RQ4: "Does having to work more hours than the regular work schedule relate to a change in productivity?"
- RQ5: "Does adopting strategies to maintain productivity have a positive impact in said productivity?"
- RQ6: "Do longer commuting home-work times (i.e., over 30 minutes) relate to a preference of remote work?"
- RQ7: "Does having worked in a remote regimen before the pandemic period relate to the frequency use of teleconference tools?"
- RQ8: "Do participants that do not feel safe about coming back to a fully on-site regimen are more likely to prefer another regimen (i.e., fully remote or hybrid) than those who feel safe?"
- RQ9: "When it comes to the hybrid regimen, do participants that have dependants in their household prefer a mainly remote regimen?"
- RQ10: "Does company employee dimension relate to the developers' feel of support to maintain productivity?"

After conceiving these research questions, the statistical analysis was performed using the IBM *Statistical Package* for the *Social Sciences* (SPSS) software for macOS, version 28.0.1.0.

 EXPERIMENTS AND RESULTS

In this chapter, the methodology, the results of the statistical analysis and its conclusions for each of the research questions are presented, along with the study's main limitations and advantages.

4.1 STATISTICAL ANALYSIS - METHODOLOGY

All analyzed variables are categorical, i.e., that have two or more categories (p.e., 'Yes' or 'No'), but there is no intrinsic ordering to the referred categories [28]. Therefore, the used methodology was the same for every RQ. The chi-squared test (χ^2) was used in order to access the existence of statistically significant differences between groups, regarding said categorical variables. Pearson's χ^2 test was used whenever the percentage of cell count expected to be less than 5 was inferior to 20%. When the referred percentage was equal or superior to 20%, the Fisher's exact test was used instead.

For measuring the effect size, the value of ϕ was used for variables that only include two categories each and the value of ϕ_c was used when at least one of the variables included more than two categories.

All the values of p that are lower than 0.05 were considered statistically significant.

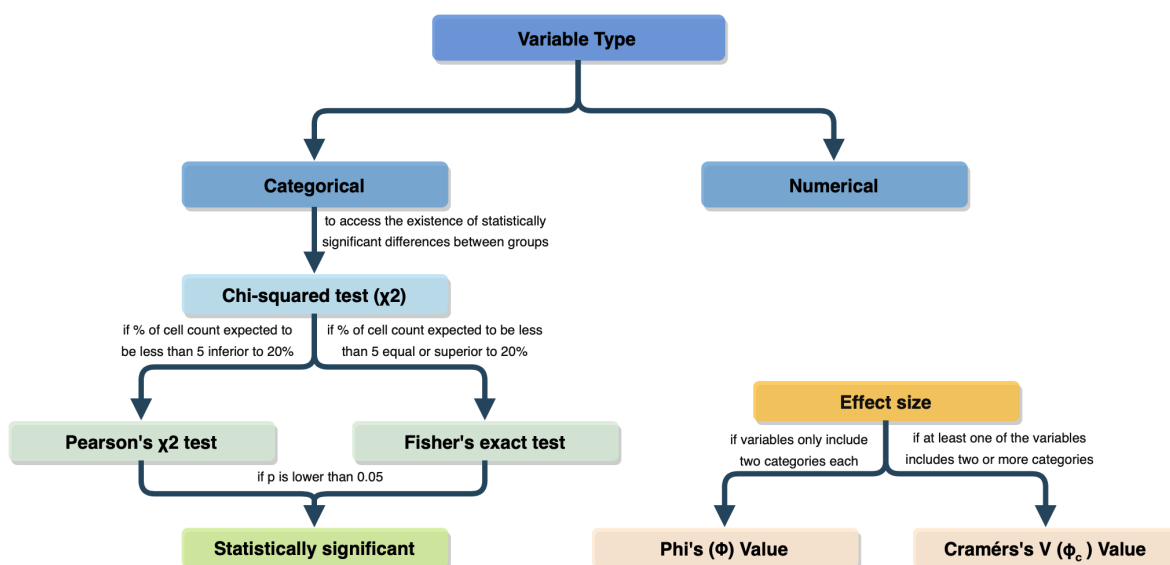


Figure 2: Statistical analysis illustrative diagram

4.2 RESULTS

4.2.1 RQ1

	Support from someone in household		Answer count	Used statistic; <i>p</i> value; <i>effect</i> size
	No	Yes		
	<i>n</i> (%)	<i>n</i> (%)		
Gender				Fisher's exact test;
Female	5 (38.5%)	8 (61.5%)	13*	<i>p</i> = 1.000;
Male	12 (36.4%)	21 (63.6%)	33*	ϕ = 0.020

*The total number of answers is 46 and not 176, since not all participants have dependants and, therefore, did not answer the questions regarding their household

Table 7: RQ1 results' overview

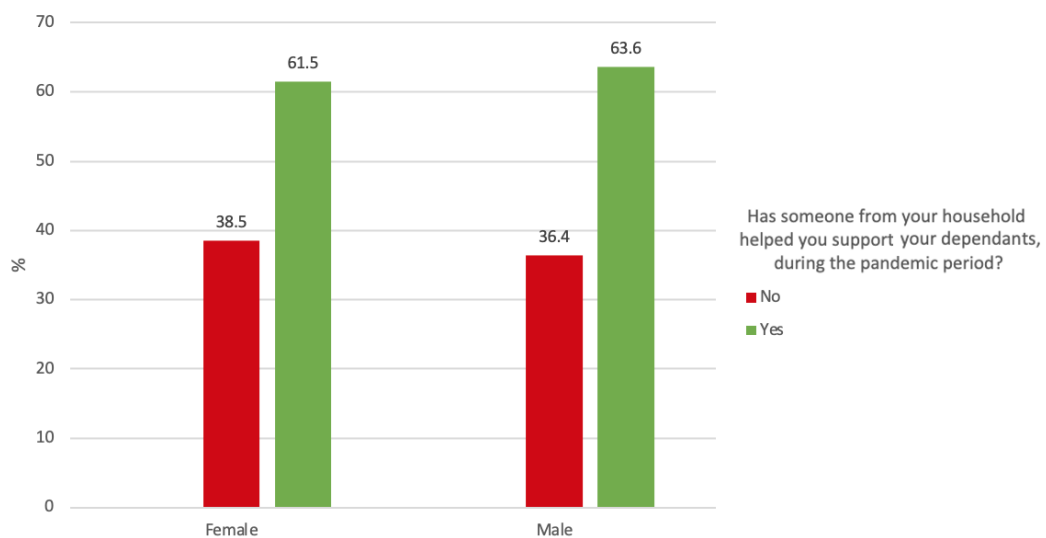


Figure 3: Relation bar graphic between gender and having support from someone in household

CONCLUSIONS: Results for the analyzed RQ “Does participants’ gender relate to having no support from someone in their household?” are not statistically significant, as can be concluded from the *p* value. Despite that, table 7 and figure 3 can still be used to analyze the aforementioned question. 38.5% of female participants and 36.4% of male participants did not have support from someone in their household, which means the difference between them is only 2.1%. Nonetheless, there were 50% less answers from female participants, which could mean that, if there had been more answers from said participants, the results could be very different. Even though with the presented data no certainty can be obtained, it still seems that gender could possibly show a relation to having no support from someone in household.

4.2.2 RQ2

	Productivity variation					Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	Decreased Significantly	Decreased Slightly	Stayed the same	Increased Slightly	Increased Significantly		
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)		
Dependants							
No	2 (1.5%)	14 (10.8%)	51 (39.2%)	44 (33.8%)	19 (14.6%)	130	Fisher's exact test; <i>p</i> = 0.404;
Yes	2 (4.3%)	6 (13.0%)	13 (28.3%)	20 (43.5%)	5 (10.9%)	46	$\phi_c = 0.145$

Table 8: RQ2 results' overview

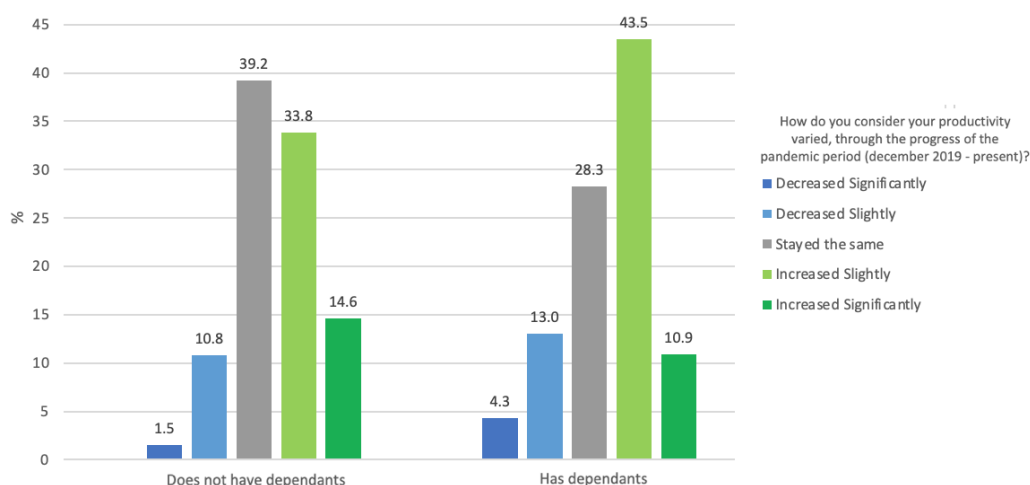


Figure 4: Relation bar graphic between having dependants and productivity variation

CONCLUSIONS: As can be seen from the *p* value in table 8, the results for the RQ “Do participants who have dependants suffer a negative impact in productivity?” are not statistically significant. Nevertheless, both the referred table and the graph (shown in figure 4) can be used in order to analyze the referred question. Productivity variation answers “Decreased Significantly” and “Decreased Slightly” were considered to be a negative impact. 4.3% of participants who have dependants and 1.5% of participants who do not have dependants answered that their productivity “Decreased Significantly”; 13.0% of participants who have dependants and 10.8% of participants who do not have dependants answered that their productivity “Decreased Slightly”. Although there were fewer answers from participants who have dependants, the percentages were still higher, which could mean that, if more answers had been collected, the results could be even more different. Curiously, 43.5% of participants who have dependants answered that their productivity “Increased Slightly” and only 33.8% of participants who do not have dependants answered the same. Even though with the presented data no solid conclusions can be obtained, it seems that having dependants could possibly show a relation to a negative impact in productivity.

4.2.3 RQ3

	Support from someone in household		Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	No	Yes		
	<i>n</i> (%)	<i>n</i> (%)		
Negatively affected at work				
No	10 (40.0%)	15 (60.0%)	25*	Pearson's χ^2 test; <i>p</i> = 0.762; ϕ = 0.069
Yes	7 (33.3%)	14 (66.7%)	21*	

*The total number of answers is 46 and not 176, since only participants who have dependants answered these questions

Table 9: RQ3 results' overview

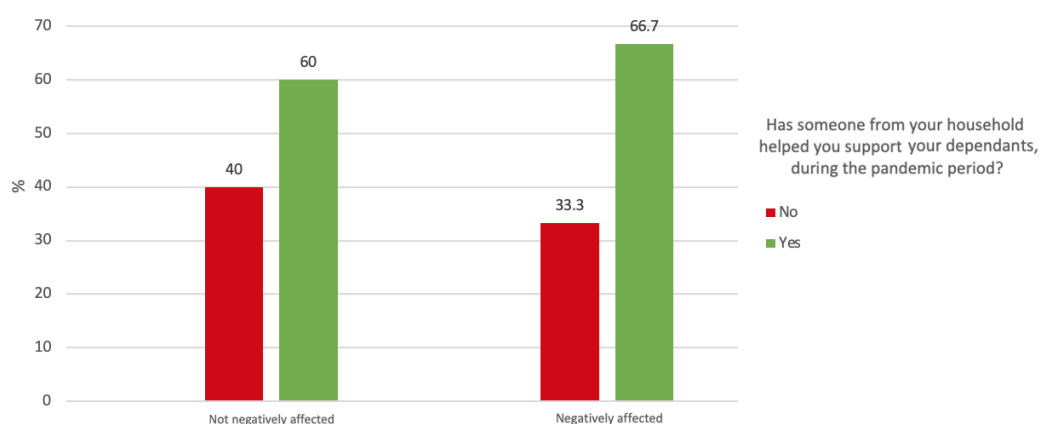


Figure 5: Relation bar graphic between being negatively affected at work and having support from someone in household

CONCLUSIONS: Data from table 9 and figure 5 can be used in order to analyze the RQ “Do participants who have dependants and no support from someone in their household are more negatively affected at work than those who do?”, although the results are not statistically significant. 33.3% of participants who have dependants and no support and 66.7% of participants who have both dependants and support were negatively affected at work. In this case and since the answer total is similar, it seems that those who have dependants and support could possibly be more negatively affected at work (contradicting the RQ), which can imply that perhaps the referred support was not sufficient or that other factors may be contributing to said negative impact. However, with the presented data, no affirmations can be made.

4.2.4 RQ4

	Productivity variation					Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	Decreased Significantly	Decreased Slightly	Stayed the same	Increased Slightly	Increased Significantly		
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)		
Comply with work hours							
No	2 (3.4%)	10 (17.2%)	18 (31.0%)	19 (32.8%)	9 (15.5%)	58	Fisher's exact test; <i>p</i> = 0.324;
Yes	2 (1.7%)	10 (8.5%)	46 (39.0%)	45 (38.1%)	15 (12.7%)	118	$\phi_c = 0.157$

Table 10: RQ4 results' overview

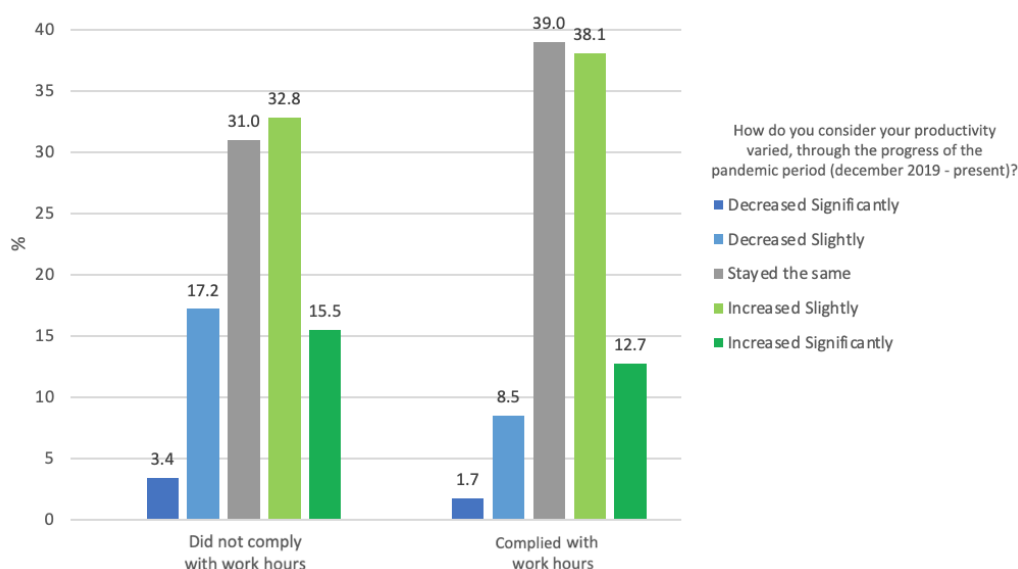


Figure 6: Relation bar graphic between complying with work hours and productivity variation

CONCLUSIONS: Analysis for the RQ “Does having to work more hours than the regular work schedule relate to a change in productivity?” is illustrated in table 10 and figure 6. As can be concluded from the *p* value in the referred table, the results are not statistically significant. Productivity variation answer “Stayed the same” was not considered as a change in productivity. 1.7% of participants that complied with the work schedule and 3.4% of participants that did not comply answered that their productivity “Decreased Significantly”; 8.5% of participants that complied with the work schedule and 17.2% of participants who worked overtime answered that their productivity “Decreased Slightly”; 12.7% of participants that complied with the work hours and 15.5% of participants that did not answered that their productivity “Increased Significantly”; 38.1% of participants that followed their regular schedule and 32.8% of participants that worked extra hours answered that their productivity “Increased Slightly”.

Even though there were approximately 50% less answers from participants that did not comply with their work hours, the percentage of variations “Decreased Slightly” and “Decreased Significantly” were around 50% higher comparing to the other group, which reveals a tendency for a decrease in productivity when work hours were not respected. As previously referred, the lack of statistical significance does not allow the attainment of certainty, however, it appears that having to work extra hours could possibly show a relation to a change in productivity.

4.2.5 RQ5

	Productivity variation					Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	Decreased Significantly	Decreased Slightly	Stayed the same	Increased Slightly	Increased Significantly		
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)		
Adopt strategies							
No	-	10 (10.9%)	39 (42.4%)	31 (33.7%)	12 (13.0%)	92	Fisher’s exact test; <i>p</i> = 0.158;
Yes	4 (4.8%)	10 (11.9%)	25 (29.8%)	33 (39.3%)	12 (14.3%)	84	$\phi_c = 0.196$

Table 11: RQ5 results’ overview

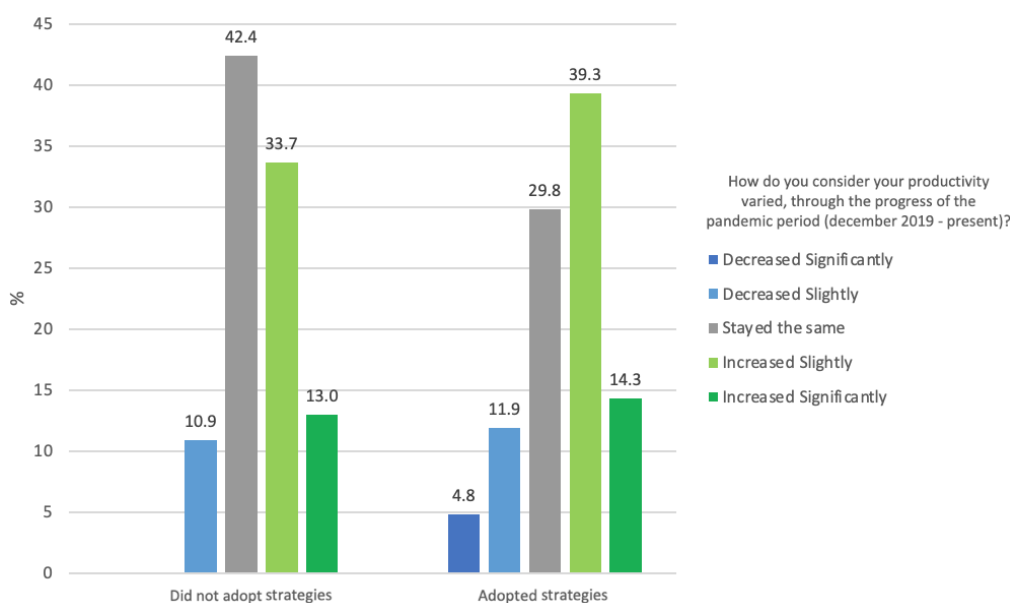


Figure 7: Relation bar graphic between adopting strategies and productivity variation

CONCLUSIONS: The *p* value from table 11 shows that the results for RQ “Does adopting strategies to maintain productivity have a positive impact in said productivity?” are not statistically significant. Yet, once again, said table and figure 7 can be used to study the referred question. Productivity variation answers “Increased Significantly” and “Increased Slightly” were considered a positive impact in productivity. 14.3% of participants that adopted

strategies and 13.0% of participants that did not adopt strategies answered that their productivity “Increased Significantly”; 39.3% of participants that adopted strategies and 33.7% of participants that did not answered that their productivity “Increased Slightly”. In this case and since the answer total is similar, it seems that adopting strategies does have some influence in a positive impact in productivity, but in a small percentage. Even though with the presented data no certainty can be obtained, the fact that different groups may consider distinct types of strategies might have affected the results.

4.2.6 RQ6

	Preferred work regimen			Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	Fully On-site regimen	Hybrid regimen	Fully Remote regimen		
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)		
Commuting h-w times					
Under 30 minutes	1 (1.2%)	72 (83.7%)	13 (15.1%)	86	Fisher’s exact test; <i>p</i> = 0.841; ϕ_c = 0.049
30 minutes to 1 hour	1 (1.3%)	63 (78.8%)	16 (20.0%)	80	
Over 1 hour	-	8 (80.0%)	2 (20.0%)	10	

Table 12: RQ6 results’ overview

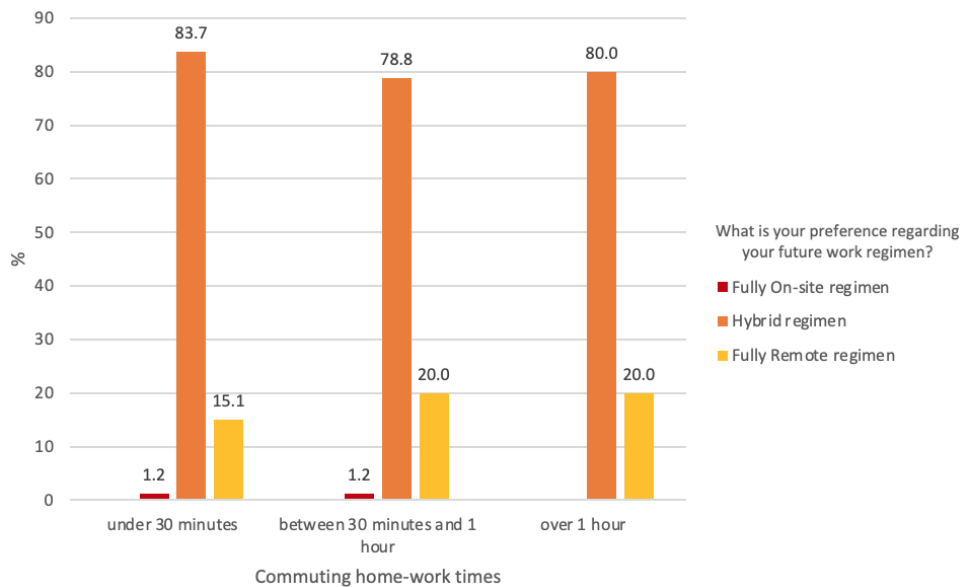


Figure 8: Relation bar graphic between commuting home-work times and preferred work regimen

CONCLUSIONS: As can be seen from *p* value in table 12, the results for RQ “Do longer commuting home-work times (i.e., over 30 minutes) relate to a preference of remote work?” are not statistically significant. Despite that, both the referred table and the graph (shown in figure 8) can be used in order to analyze the question in hand.

20.0% of participants that take 30 minutes to 1 hour and 20.0% of participants that take over 1 hour to commute to work answered that they preferred a “Fully Remote regimen”; 1.3% of participants that take 30 minutes to 1 hour preferred a “Fully On-site regimen”, an option that was not considered by participants that take over 1 hour; 78.8% of participants that take 30 minutes to 1 hour and 80.0% of participants that take over 1 hour to commute to work answered that they preferred a “Hybrid regimen”. Although there were fewer answers from participants that take over 1 hour to commute to work, more than half of the participants prefer a hybrid regimen, which also has a remote component. As such, it appears that participants who take longer to commute to work tend to prefer remote activity (even if in part). Curiously, participants that commute in under 30 minutes also demonstrate the same tendency. This fact may indicate that commuting times are not the primary factor for choosing remote work.

4.2.7 RQ7

	Same frequency use of teleconference tools		Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	No	Yes		
	<i>n</i> (%)	<i>n</i> (%)		
Past remote regimen				
No	83 (66.4%)	42 (33.6%)	125	Pearson’s χ^2 test; <i>p</i> = 0.019; ϕ = 0.180
Yes	24 (47.1%)	27 (52.9%)	51	

Table 13: RQ7 results’ overview

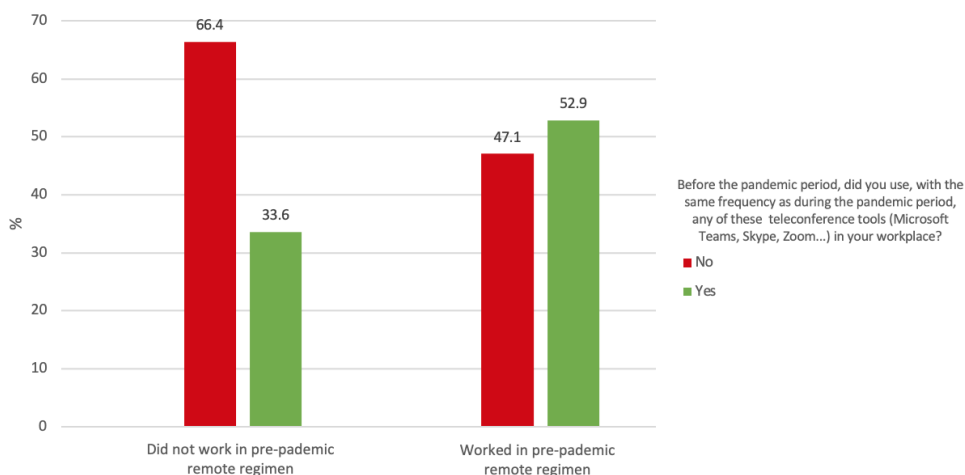


Figure 9: Relation bar graphic between past remote regimen and same frequency use of teleconference tools

CONCLUSIONS: Differently from the previous RQ, question “Does having worked in a remote regimen before the pandemic period relate to the frequency use of teleconference tools?” results are statistically significant. Table 13 and figure 9 will be used to analyze it. 33.6% of participants who did not work in a remote regimen in the past and 52.9% of participants who did work in a past remote regimen used teleconference tools with the same frequency

as before the pandemic period. Although there were almost half less answers from participants who worked in a past remote regimen, the aforementioned percentage is still much higher. In this case with the presented data, it can be affirmed that having worked in a remote regimen before the pandemic period has a relation with a higher frequency use of teleconference tools. Here, the value of ϕ is greater than 0.15 which means that said relation is strong (according to [29], p. 92, table 2).

Effectively, participants that have worked in a remote regimen before the pandemic period had to use teleconference tools to communicate with their team members or attend meetings. Essentially, their job was exactly the same, only the time period when it occurred changed. Thus, the frequency use of those tools is somewhat expected to be similar in both periods (i.e., before and after the pandemic). On the other hand, participants that did not work in a remote regimen in the past probably never used teleconference tools in their tasks or used them in fewer occasions, which confirms the smaller frequency use of those tools.

4.2.8 RQ8

	Preferred work regimen			Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	Fully On-site regimen	Hybrid regimen	Fully Remote regimen		
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)		
Safe about Fully On-site					
Significantly Insecure	-	11 (61.1%)	7 (38.9%)	18	Fisher’s exact test; <i>p</i> = 0.032; ϕ_c = 0.213
Slightly Insecure	-	24 (85.7%)	4 (14.3%)	28	
Neutral	-	41 (78.8%)	11 (21.2%)	52	
Slightly Secure	-	29 (96.7%)	1 (3.3%)	30	
Significantly Secure	2 (4.2%)	38 (79.2%)	8 (16.7%)	48	

Table 14: RQ8 results’ overview

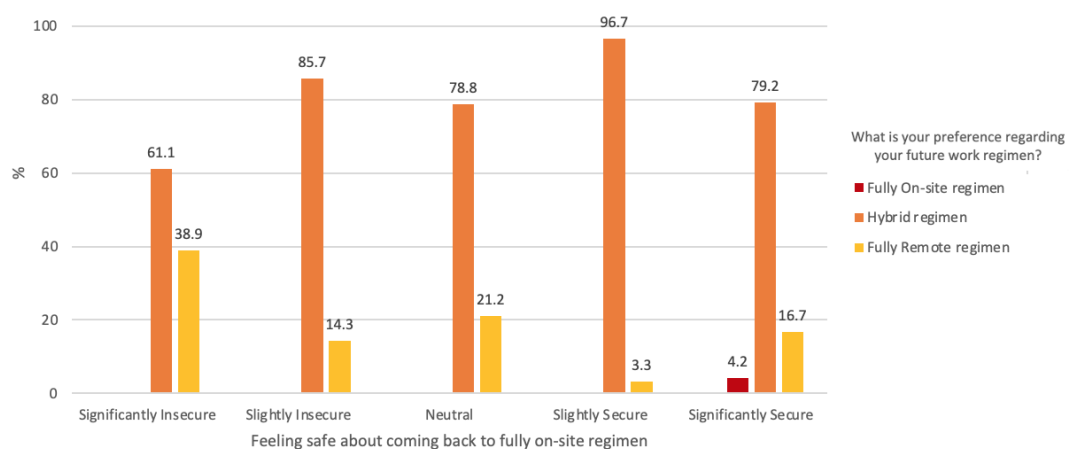


Figure 10: Relation bar graphic between feeling safe about fully on-site regimen and preferred work regimen

CONCLUSIONS: Like the previous RQ, question “*Do participants that do not feel safe about coming back to a fully on-site regimen are more likely to prefer another regimen (i.e., fully remote or hybrid) that those who feel safe?*” is statistically significant. Similarly, table 14 and figure 10 will be used to analyze it. A “Neutral” feeling towards the RQ was not considered in the analysis. 38.9% of participants who feel “Significantly Insecure” prefer a fully remote regimen, whereas 61.1% prefer a hybrid regimen; 14.3% and 85.7% of participants who feel “Slightly Insecure” prefer a fully remote or a hybrid regimen, respectively; 16.7% of participants who feel “Significantly Secure” prefer a fully remote regimen, while 79.2% prefer a hybrid regimen; 3.3% and 96.7% of participants that feel “Slightly Secure” prefer a fully remote or a hybrid regimen, respectively. Although there were fewer answers from participants that do not feel completely safe about coming back to a fully on-site regimen, with the presented data, it can be affirmed that the referred participants are more likely to prefer a fully remote regimen than those who feel safe. Interestingly, when it comes to participants who feel safe to come back to on-site work, they would still prefer to switch to a hybrid regimen. Here, the value of ϕ_c is greater than 0.15 which means that the relation between both analyzed variables is strong (according to [29], p. 92, table 2).

It is somewhat expected that participants who do not feel safe about coming back to a fully on-site regimen would more likely prefer a fully remote regimen when comparing to the ones who do feel safe. This regimen allows them to avoid being in their physical workplace and possibly being infected with viruses. In this case, a mainly remote hybrid regimen would always imply that part of work hours had to be spent on-site, which could still be another viable alternative if their company did not allow a fully remote regimen. On the other hand, participants who feel safe about coming back to a fully on-site regimen tend to prefer a hybrid regimen, which may seem peculiar, but said regimen can provide an on-site portion and, at the same time, the comfort of working remotely, reducing commuting times and fees and allowing a better schedule management.

4.2.9 RQ9

	Preferred hybrid regimen			Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	Mainly On-site	Balanced Hybrid	Mainly Remote		
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)		
Dependants					Pearson's χ^2 test;
No	9 (8.3%)	30 (27.5%)	70 (64.2%)	109*	<i>p</i> = 0.135;
Yes	6 (17.6%)	12 (35.3%)	16 (47.1%)	34*	$\phi_c = 0.167$

*The total number of answers is 143 and not 176, since not every participant prefers a hybrid regimen

Table 15: RQ9 results' overview

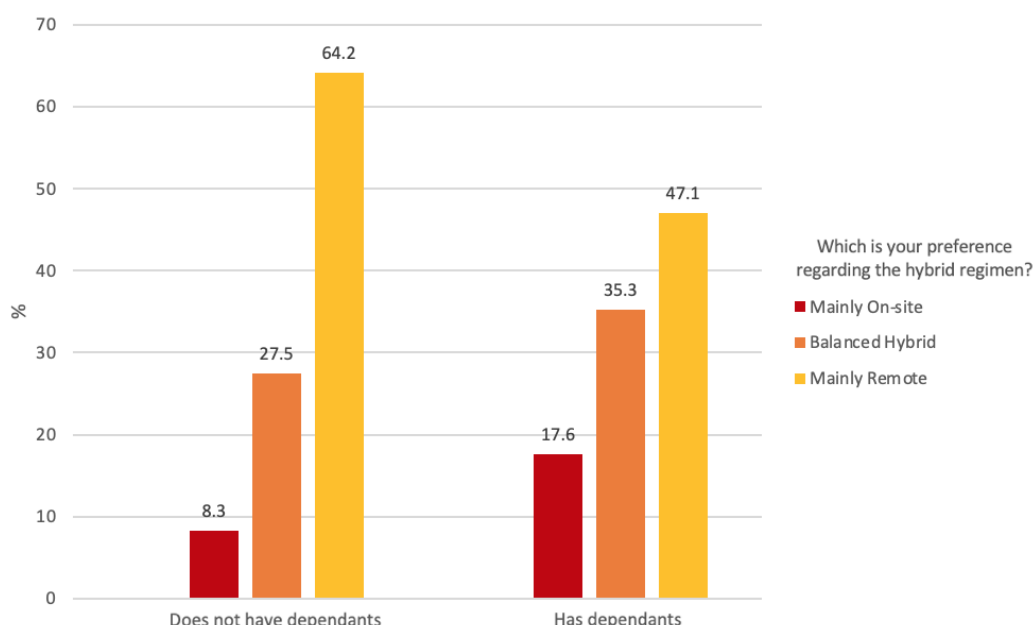


Figure 11: Relation bar graphic between preferred hybrid regimen and dependants

CONCLUSIONS: Results for RQ “When it comes to the hybrid regimen, do participants who have dependants in their household prefer a mainly remote regimen?” are illustrated in table 15 and figure 11. As can be seen from the *p* value, said results are not statistically significant. 47.1%, 17.6% and 35.3% of participants that have dependants prefer a mainly remote, a mainly on-site or a balanced hybrid regimen, respectively. Although there were far fewer answers from participants who have dependants, the mainly remote regimen still has a higher percentage. Curiously, when comparing to participants who do not have dependants, there is over 50% more participants that prefer a mainly on-site regimen. Thus, even though this data is not statistically significant, it seems that having dependants could possibly show a relation to a preference for a mainly on-site regimen, contradicting the RQ.

This can be explained in part due to the fact that taking care of their dependants for long periods may have had a negative impact in their personal and professional lives.

4.2.10 RQ10

Company dimension	Support from company (productivity)		Answer count	Used statistic; <i>p</i> value; <i>effect size</i>
	No	Yes		
	<i>n</i> (%)	<i>n</i> (%)		
Small enterprises (10 to 49 employees)	15 (31.3%)	33 (68.8%)	48*	Pearson's χ^2 test; <i>p</i> = 0.334; ϕ_c = 0.113
Medium-sized enterprises (50 to 249 employees)	10 (24.4%)	31 (75.6%)	41*	
Large enterprises (250 employees or more)	16 (19.8%)	65 (80.2%)	81*	

*The total number of answers is 170 and not 176, since some participants preferred not to say in which company they work at

Table 16: RQ10 results' overview

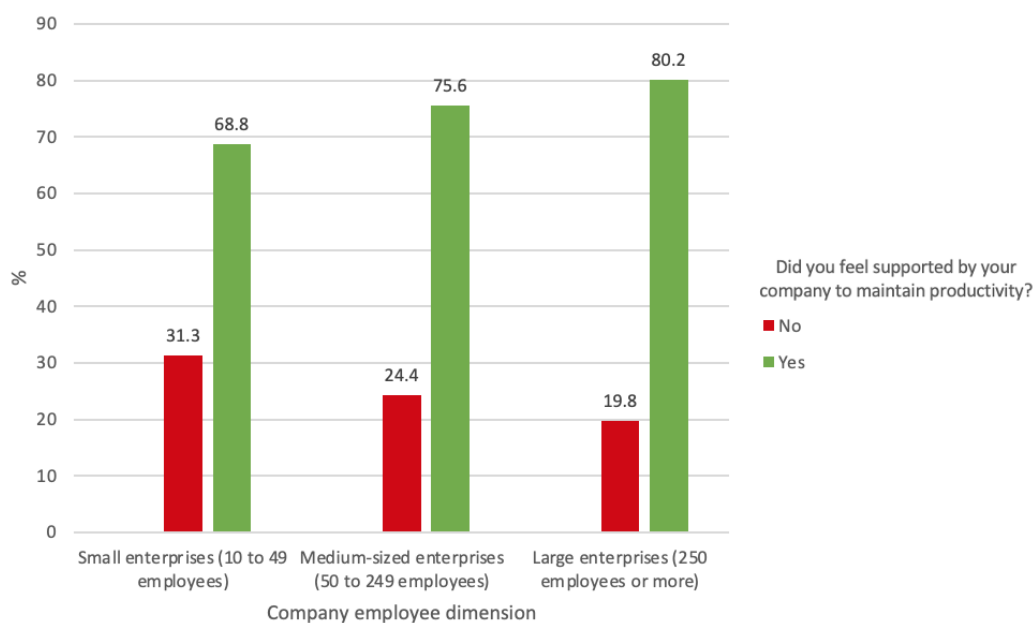


Figure 12: Relation bar graphic between company employee dimension and support to maintain productivity

CONCLUSIONS: As can be seen from p value in table 16, the results for RQ “Does company employee dimension relate to the developer's feel of support to maintain productivity?” are not statistically significant. In spite of that, the question was analyzed using both the referred table and the graph (shown in figure 12). 68.8% of participants from small enterprises, 75.6% from medium-sized enterprises and 80.2% from large enterprises felt support to maintain productivity. Even though with the presented data no certainty can be achieved, it seems that company employee dimension could possibly show a relation to developers' feel of support to maintain productivity. Nonetheless, the major percentage actually belongs to the large enterprise dimension and not the small enterprise, which may seem peculiar, since small enterprises have less employees and, therefore, have greater opportunities to provide more support. The fact that there were more answers from participants who work in large enterprises can explain this, which could mean that results could differ if there had been more answers from the other groups.

4.3 STUDY'S LIMITATIONS AND ADVANTAGES

Firstly, it should be noted that in RQ2, RQ4, RQ5, RQ6, RQ8 and RQ10 the row total does not add up to 100%, but rather 99.9% or 100.1%. This happens due to rounding off of values.

One of the main study's limitation is the sample size. With a higher number of answers, some of the RQ could become statistically significant. Another limitation is the fact that some companies provided many more answers than others, mainly due to the fact that those are large enterprises with more employees, which can lead to biased results.

Allowing answers only from software professionals that work in Portugal and creating a survey from scratch, turned this study into the first one to be conducted in Portuguese workers alone. This was a requisite that I wanted to follow from the beginning, since Portugal is a country with many software companies and a lot of employees qualified for this type of study that had never been explored.

Thus, and considering these limitations and advantages, the results of this study should be found relevant but interpreted with some caution.

CONCLUSIONS AND FUTURE WORK

5.1 CONCLUSIONS

The **COVID-19** pandemic has been devastating in multiple domains, and its impact can not be fully calculated and most certainly will never be forgotten. With that in mind, the main objective of this dissertation is to study one of the impacts that this **COVID-19** pandemic (December 2019 - present) caused, i.e., the impact that the change to remote work caused (in multiple levels) to software professionals.

Firstly, a study of the **SOTA** on **COVID-19** articles was presented, mainly about the life of software developers that worked from home during the pandemic period, but also a book that helped with the questionnaire's construction. Later, all the steps necessary to study the aforementioned impact were depicted, starting with its target population and inclusion criteria, then the study's main objectives, questionnaire's structure and survey's content, with a full description of each section/domain and the intended analysis, and an overview on the obtained dataset with a frequency analysis on some of the variables that characterize the sample. After that, the 10 elaborated **RQ** for the statistical analysis were introduced.

Lastly, the statistical methodology used for the performed analysis and all the results and conclusions associated with the research questions were presented, along with some tables and graphs to corroborate said analysis. The study's limitations and advantages were also shown.

5.1.1 *Questionnaire and survey overview*

The conceived questionnaire's structure consists of 20 sections and 40 questions not all mandatory, since a certain answer may skip some sections and questions. The first two questions were used to exclude irrelevant answers. Three questions were then asked to characterize participants' personal data. From the referred questions, one can conclude that (i) male participants represent the majority of answers, while female participants only account for 23% of the sample; (ii) the age group 18-35 constitutes over 72% of the sample, and (iii) even though all the answers belong to Portuguese workers, over 9% were not born in Portugal. Five questions were asked to characterize participants' professional data, although only four were used in the analysis and one of these (company name) was turned into a category. From the aforementioned questions, one can affirm that (i) over 88% of participants either have a masters or a bachelor's degree; (ii) participants work mainly in Braga (63%),

Lisbon (15%) and Porto (8%); (iii) company employee dimension is mostly large (46%), and (iv) the three most common job positions belong to the same group, i.e., developers (Full-Stack (15%), Back-End (10%) and Web (8%)). The remainder questions intend to analyze the multiple studied domains, such as dependants, work hours, productivity, preferred work regimen, among others. It should be noted that questions that involved writing and some regarding, p.e., “housing” and “necessary equipment” were not considered for the statistical analysis, since most answers had nothing to do with the pandemic and change to remote work.

After the survey’s conduction, in total, 195 answers were collected from software professionals from Portugal, but solely 176 of them were valid (i.e., workers based in Portugal that had transacted to a remote regimen during the pandemic).

5.1.2 Statistical analysis results overview

Only research questions 7 and 8 were statistically significant:

- **RQ7**, i.e., “Does having worked in a remote regimen before the pandemic period relate to the frequency use of teleconference tools?”, indicated that having worked in a remote regimen before the pandemic period has a strong relation with a higher frequency use of teleconference tools after this period, which is reasonable since these participants were already familiarized with the use of said tools;
- **RQ8**, i.e., “Do participants that do not feel safe about coming back to a fully on-site regimen are more likely to prefer another regimen (i.e., fully remote or hybrid) that those who feel safe?”, demonstrated that participants who do not feel safe about coming back to a fully on-site regimen are more likely to prefer a fully remote regimen than the ones who feel safe and the latter are more likely to prefer a hybrid regimen. This seems coherent, since a fully remote regimen avoids being in a “public” workplace and a hybrid regimen implies that, in some days, the job has to be done on-site. Like in the previous **RQ**, this relation is also strong.

All the other research questions were not statistically significant, possibly due to the slightly small sample size. Nonetheless, even though it can not be said with certainty, some ideas can be formulated, p.e.:

- having dependants and support in their care from someone in participants’ household could possibly negatively affect their work;
- having dependants could possibly show a relation to a preference for a mainly on-site hybrid regimen;
- company employee dimension could show a relation to participants’ feel of support to maintain productivity.

5.1.3 Literature parallelism

The literature review presented in chapter 2 allowed to better comprehend all prior existent knowledge on this theme. Even though only two of the 10 elaborated **RQ** were statistically significant, some parallelism between this

study and said literature can be drawn.

Following the findings in RQ2, RQ4 and RQ5, productivity possibly suffered both positive and negative impacts (depending on the question), agreeing with what BAO et al. also concluded. In particular, the referred conclusion is not in line with:

- BEZERRA et al. who claims that productivity mostly did not suffer a negative impact;
- RUSSO et al. who states that productivity did not change;
- GULER et al. who declares that productivity increased in general;
- ŠMITE et al. who affirms that productivity did not change significantly.

By analyzing RQ3 graph one can conclude that having dependants and support from someone in developers' household seems to impact their productivity more negatively than those who do not have support. FORD et al. reached a similar conclusion on productivity impact when considering proximity to family members claiming that it is beneficial for some and detrimental for others.

RQ1 hinted that gender could possibly show a relation to having no aid in caregiving of dependants. Even though there were less 50% female answers, they still had a slightly bigger percentage of not getting support when comparing to male ones. RUSSO et al. states that gender does not reveal any differences in their considered variables, which, in this study's case, is not entirely accurate. On the other hand, MACHADO et al. reached a similar conclusion to this study regarding gender vs lack of support and childcare, with the proviso that, in this study's case, dependants refer to both children and elderly (p.e., parents or parents-in-law).

In the revised literature no similar or different conclusions were made that can relate to RQ6 (developers that take longer to commute to work tend to prefer remote activity (even if in part)), RQ9 (having dependants could possibly show a relation to a preference for a mainly on-site regimen) and RQ10 (company employee dimension could possibly show a relation to developers' feel of support to maintain productivity) results. The same situation happened for RQ7 and RQ8, although, since both of them are statistically significant in this study, they have a mathematical background that permits their corroboration with certainty for the analyzed population.

5.2 FUTURE WORK

One possible increment to this study would be to broaden its "horizon", i.e., conduct the survey in other countries and possibly find a relation between them and its policies. Another possibility would be to conduct the same survey again and try to obtain more answers in order to make some research questions statistically significant. To expand this study, one could also elaborate another questionnaire and conduct another survey on these same companies in order to understand if there were some changes and how did they adapt, now that the pandemic has changed and progressed. Additionally, it is intended to publish this study as a scientific article.

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Part III

APPENDICES



SURVEY

The elaborated survey (the English version) for this dissertation is included below or in the [link](#).

The impact of change to remote work due to the COVID-19 pandemic

I am a 5th year student of Informatics Engineering Integrated Masters at University of Minho and I am developing my thesis dissertation on the theme "Analysis of the impact of COVID-19 in software development teams".

This survey intends to analyse the impact that the change to remote work, due to the COVID-19 pandemic (december 2019 - present), caused (in multiple levels) to members of software development teams.

Thank you in advance for your availability and contribution to this survey.

***Required**

1. You acknowledge that your data are confidential and anonymous and consent to their use for academic purposes

Mark only one oval.

Yes

No

On-site regimen to Remote regimen

2. During the pandemic period (december 2019 - present), did you change from on-site regimen to remote regimen?

Mark only one oval.

Yes

No

Personal data

3. What is your age group? *

Mark only one oval.

18-35

36-50

51-65

65+

4. What is your gender? *

Mark only one oval.

Female

Male

Other

I prefer not to say

5. What country were you born in? *

Mark only one oval.

Afghanistan

Akrotiri

Albania

Algeria

American Samoa

Andorra

Angola

Anguilla

Antarctica

Antigua and Barbuda

Argentina

Armenia

- Aruba
- Ashmore and Cartier Islands
- Australia
- Austria
- Azerbaijan
- Bahamas, The
- Bahrain
- Bangladesh
- Barbados
- Bassas da India
- Belarus
- Belgium
- Belize
- Benin
- Bermuda
- Bhutan
- Bolivia
- Bosnia and Herzegovina
- Botswana
- Bouvet Island
- Brazil
- British Indian Ocean Territory
- British Virgin Islands
- Brunei
- Bulgaria
- Burkina Faso
- Burma
- Burundi
- Cambodia
- Cameroon
- Canada
- Cape Verde

- Cayman Islands
- Central African Republic
- Chad
- Chile
- China
- Christmas Island
- Clipperton Island
- Cocos (Keeling) Islands
- Colombia
- Comoros
- Congo, Democratic Republic of the
- Congo, Republic of the
- Cook Islands
- Coral Sea Islands
- Costa Rica
- Cote d'Ivoire
- Croatia
- Cuba
- Cyprus
- Czech Republic
- Denmark
- Dhekelia
- Djibouti
- Dominica
- Dominican Republic
- Ecuador
- Egypt
- El Salvador
- Equatorial Guinea
- Eritrea
- Estonia
- Ethiopia

- Europa Island
- Falkland Islands (Islas Malvinas)
- Faroe Islands
- Fiji
- Finland
- France
- French Guiana
- French Polynesia
- French Southern and Antarctic Lands
- Gabon
- Gambia, The
- Gaza Strip
- Georgia
- Germany
- Ghana
- Gibraltar
- Glorioso Islands
- Greece
- Greenland
- Grenada
- Guadeloupe
- Guam
- Guatemala
- Guernsey
- Guinea
- Guinea-Bissau
- Guyana
- Haiti
- Heard Island and McDonald Islands
- Holy See (Vatican City)
- Honduras
- Hong Kong

- Hungary
- Iceland
- India
- Indonesia
- Iran
- Iraq
- Ireland
- Isle of Man
- Israel
- Italy
- Jamaica
- Jan Mayen
- Japan
- Jersey
- Jordan
- Juan de Nova Island
- Kazakhstan
- Kenya
- Kiribati
- Korea, North
- Korea, South
- Kuwait
- Kyrgyzstan
- Laos
- Latvia
- Lebanon
- Lesotho
- Liberia
- Libya
- Liechtenstein
- Lithuania
- Luxembourg

- Macau
- Macedonia
- Madagascar
- Malawi
- Malaysia
- Maldives
- Mali
- Malta
- Marshall Islands
- Martinique
- Mauritania
- Mauritius
- Mayotte
- Mexico
- Micronesia, Federated States of
- Moldova
- Monaco
- Mongolia
- Montserrat
- Morocco
- Mozambique
- Namibia
- Nauru
- Navassa Island
- Nepal
- Netherlands
- Netherlands Antilles
- New Caledonia
- New Zealand
- Nicaragua
- Niger
- Nigeria

- Niue
- Norfolk Island
- Northern Mariana Islands
- Norway
- Oman
- Pakistan
- Palau
- Panama
- Papua New Guinea
- Paracel Islands
- Paraguay
- Peru
- Philippines
- Pitcairn Islands
- Poland
- Portugal
- Puerto Rico
- Qatar
- Reunion
- Romania
- Russia
- Rwanda
- Saint Helena
- Saint Kitts and Nevis
- Saint Lucia
- Saint Pierre and Miquelon
- Saint Vincent and the Grenadines
- Samoa
- San Marino
- Sao Tome and Principe
- Saudi Arabia
- Senegal

- Serbia and Montenegro
- Seychelles
- Sierra Leone
- Singapore
- Slovakia
- Slovenia
- Solomon Islands
- Somalia
- South Africa
- South Georgia and the South Sandwich Islands
- Spain
- Spratly Islands
- Sri Lanka
- Sudan
- Suriname
- Svalbard
- Swaziland
- Sweden
- Switzerland
- Syria
- Taiwan
- Tajikistan
- Tanzania
- Thailand
- Timor-Leste
- Togo
- Tokelau
- Tonga
- Trinidad and Tobago
- Tromelin Island
- Tunisia
- Turkey

- Turkmenistan
- Turks and Caicos Islands
- Tuvalu
- Uganda
- Ukraine
- United Arab Emirates
- United Kingdom
- United States
- Uruguay
- Uzbekistan
- Vanuatu
- Venezuela
- Vietnam
- Virgin Islands
- Wake Island
- Wallis and Futuna
- West Bank
- Western Sahara
- Yemen
- Zambia
- Zimbabwe

Academic and Professional data

6. What is your academic background? *

Mark only one oval.

- Professional course
- Bachelor's degree
- Masters
- PhD
- Other: _____

7. What is the name of the company you work in? *

8. Which city do you work at? *

9. What is your job position at the company? *

Mark only one oval.

- 3D Graphics Developer
- Back-End Developer
- Business Analyst
- Chief Executive Officer (CEO)
- Chief Information Officer (CIO)
- Chief Technology Officer (CTO)
- Commercial
- Data Engineer
- DevOps Engineer
- Embedded Systems Developer
- Full-Stack Developer
- Integration Developer
- Mobile Developer
- Product Designer
- Project Manager
- Quality Engineer
- Security Engineer
- Support Engineer
- System Administrator
- System Analyst
- Systems Architect
- Test Engineer
- Web Developer
- Other: _____

10. What is the main area of your job position? (according to SWEBOK's 3.0 version) *

Mark only one oval.

- Software Requirements
- Software Design
- Software Construction
- Software Testing
- Software Maintenance
- Software Configuration Management
- Software Engineering Management
- Software Engineering Process
- Software Engineering Models and Methods
- Software Quality

Ascendants/Descendants

11. Do you have dependants (elderly or children younger than 12 years old) living with you? *

Mark only one oval.

- Yes
- No *Skip to question 18*

Household

12. How many people are in your household (yourself included)? *

Mark only one oval.

- 1
- 2
- 3
- 4
- 5 or more

13. Has having to support your dependants (elderly or children younger than 12 years old) negatively affected your work, during the pandemic period (december 2019 - present)?

Mark only one oval.

- Yes
- No

14. Has someone from your household helped you support your dependants, during the pandemic period?

Mark only one oval.

- Yes
- No *Skip to question 18*

Caregiver support

15. Who helped you support your dependants (elderly or children younger than 12 years old)?

16. Did your company take action to aid you in your caregiver situation? *

Mark only one oval.

Yes

No *Skip to question 18*

Aid measures

17. Which were some of the actions taken by your company to aid you? *

Working Hours

18. Did you comply with your working hours, without the need to work extra hours, to compensate for eventual distractions at home?

Mark only one oval.

Yes *Skip to question 20*

No

Extra hours

19. How many extra hours per day, in average, did you work, compared to the hours you would work in on-site regimen?

Mark only one oval.

- 1
- 2
- 3 or more

Commuting to work and housing

In home-workplace and workplace-home commute questions, if it takes you, for example, 15 minutes, write it as 00:15

20. How much time do you take, in average, to commute from your home to your workplace?

Example: 8.30 a.m.

21. How much time do you take, in average, to commute from your workplace to your home?

Example: 8.30 a.m.

22. Did you move to another house during the pandemic period (december 2019 - present)?

Mark only one oval.

- Yes
- No *Skip to question 24*

Moving from your house

23. Why did you move? *

Productivity

24. How do you consider your productivity varied, through the progress of the pandemic period (december 2019 - present)?

Mark only one oval.

- Decreased Significantly
- Decreased Slightly
- Stayed the same
- Increased Slightly
- Increased Significantly

25. Did you feel supported by your company to maintain productivity? *

Mark only one oval.

- Yes
- No

26. Did you adopt any strategy to maintain your productivity? *

Mark only one oval.

Yes

No *Skip to question 28*

Productivity Strategies

27. Which were some of those strategies? *

Remote regimen

28. Before the pandemic period (december 2019 - present), have you ever worked in remote regimen?

Mark only one oval.

Yes

No

29. During the pandemic period, which were the two types of internal communication tools that were more frequently used to interact with your team?

Tick all that apply.

- Teleconference communication (Microsoft Teams, Skype, Zoom...)
- Asynchronous communication (Email, Blogs...)
- Social Media communication (Messenger, WhatsApp...)
- Project management (Slack, Trello...)
- File transferring (WeTransfer, Dropbox...)
- Other: _____

30. Before the pandemic period, did you use, with the same frequency as during the pandemic period, any of these teleconference tools (Microsoft Teams, Skype, Zoom...) in your workplace?

Mark only one oval.

- Yes
- No

31. During the pandemic period, which were the software methodologies adopted by your team/company?

Tick all that apply.

- None
- Iterative and Incremental development
- Waterfall model
- Spiral model
- V-Model
- eXtreme programming
- Scrum
- Staged delivery
- Other

32. During the pandemic period, was it necessary to acquire new equipment/services suitable to remote regimen?

Mark only one oval.

Yes

No *Skip to question 35*

Necessary Equipments

33. Which equipments and/or services did you acquire? *

34. Has any of those equipments/services been provided to your by your company? *

Mark only one oval.

Yes

No

Future work regimen

35. How safe do you feel about coming back (whether it has already happened, or will still happen) to a fully on-site regimen?

Mark only one oval.

- Significantly Insecure
- Slightly Insecure
- Neutral
- Slightly Secure
- Significantly Secure

36. What is your preference regarding your future work regimen? *

Mark only one oval.

- Fully On-site regimen
- Hybrid regimen *Skip to question 39*
- Fully Remote regimen *Skip to question 38*

Fully On-site regimen

37. Which are the main factors that justify your preference for the on-site regimen? *

Fully Remote regimen

38. Which are the main factors that justify your preference for the remote regimen? *

Hybrid regimen

39. Which is your preference regarding the hybrid regimen? *

Mark only one oval.

- Mainly On-site
- Balanced Hybrid
- Mainly Remote

40. Which are the main factors that justify your preference for the hybrid regimen? *

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