

## Abstract

The COVID-19 pandemic catalyzed a widespread shift toward remote work, ultimately raising important questions surrounding its impact on employee well-being and productivity. This study investigates the relationship between remote work and work-life balance using survey data from over 1500 public sector employees in New South Wales (NSW), Australia. After cleaning and preprocessing the dataset to remove outliers and irrelevant variables, key indicators such as percentage of remote work, self-reported productivity, collaboration ease, and differences in personal time and commute hours between in-office and remote workdays were analyzed.

Preliminary Analyses using a wilcoxon signed-rank test revealed that remote work significantly increases personal time, supporting a hypothesis that work-life balance has improved. A multiple linear regression further demonstrated that both the proportion of remote work and the ease of remote collaboration are strong predictors of perceived productivity. The model shows that while saved commute time offers marginal benefits, collaboration quality is the most influential factor in enhancing productivity during remote work.

These findings align with existing research and enforces the importance of employer support and collaboration tools in remote work settings. Despite limitations related to self-reported data, the study offers valuable insights for flexible work policies that improve employee satisfaction as well as, potentially, an organization's performance.

## Introduction

Remote work has become an integral piece of employment in the modern-day, especially after its rise in 2020 during the COVID-19 pandemic in which there was a shift away from traditional, in-person office settings. As companies continue to adopt or maintain varying forms

of work arrangements, understanding the overall impact of remote work on employee work-life balance grows increasingly important. This research proposal paper discusses and outlines a project that investigates the effect of remote work on work-life balance among employees, focusing on important subjects related to work such as job satisfaction, productivity, and employee well-being. The project aims to discuss the effect of work from home (WFH) on companies and employees, and to continue discussion on whether or not remote work is here to stay. Does remote work improve work-life balance, and if so, how can it be maximized? This project aims to analyze qualitative insights and quantitative metrics in order to understand whether remote work leads to a measurable improvement in work-life balance and what organizational factors may moderate this effect.

## **Literature Review**

Bloom et al. (2015) utilized a random control trial in order to assess the impact of remote work on performance and satisfaction at a large Chinese travel agency, CTrip. They observed a 13% increase to productivity, and saw that up to 50% of the firm eventually adopted WFH policies which led to a staggering 22% productivity boost. The paper cites methodology to assess weekly performance prior to and during the experiment. Despite the productivity boosts, the study also mentions potential downsides of WFH such as employees reporting feelings of isolation from their coworkers from WFH.

Gejendran et al. (2007) provided a meta-analysis based on findings from numerous studies based on telecommuting, highlighting positive outcomes such as, increased autonomy and job satisfaction as well as the negative outcomes such as, work-family conflicts. The study

observed quantified effects of remote work across varying contexts highlighting mediating factors that influenced individual outcomes.

Wang et al. (2021) applied regression analyses, semi-structured interviews, and survey data to evaluate how managerial support and task design influenced remote work effectiveness. They were able to identify key variables affecting remote work, such as managerial support, task design, and influence on employees WFH. The findings from the paper highlight the role organizational support has on enhancing work-life balance for remote workers. The paper discusses many potential negative effects they discovered through their surveys as well, such as work-home interference, ineffective communication, procrastination, and loneliness. Even more, they identified the characteristics that had an effect on their experiences such as, social support, job autonomy, monitoring, and overall workload.

Golden et al. (2005) examined the relationship between remote work and job satisfaction by running an analysis on 321 employees. Through their analysis they found that there's a curvilinear relationship between telecommuting and job satisfaction with a plateau of job satisfaction at extensive levels of telecommuting. The paper concludes that there is a measurable quantity of remote work that can be done in order to maximize employee job satisfaction.

Gibbs et al. (2023) focuses on the impact of WFH on employee productivity utilizing personnel and analytics data from IT professionals. Researchers employed statistical analyses to compare hours worked and various productivity metrics before and during WFH arrangements were made. They found that hours worked increased and performance fell as a result of increased time spent on coordination, an increase in meetings, and the shrinking of uninterrupted work hours.

Prasad et al. (2023) focuses on the influence of remote work on work-life balance amongst IT employees, when considering the mediating and moderating of social support. Focusing on the use of statistical methods such as mediation and moderation analyses the researchers found that increase in social support positively affected work-life balance metrics.

Attri et al. (2023) investigates the impact of technology on work-life balance for remote workers in India. Data was gathered from 270 survey respondents and utilized statistical methods such as partial least squares structural equation modeling in order to analyze data. The findings suggest that technology is incredibly important to work life balance for remote workers, highlighting the importance of effective remote work with proper technology improving work-life balance.

## Methodology

### Dataset & Preprocessing

Initially, steps were taken to research and identify a dataset with meaningful data that could provide insight into or an answer to the research question. Initial stages of data sourcing utilized a multitude of academic and institutional databases relevant to the research topic. The Kaggle dataset repository holds a massive database that has been used in empirical studies across various research journals and papers. Through Kaggle's repository, a Remote Working Survey created and utilized by the New South Wales (NSW) government of 1500 people that work in New South Wales was discovered.

The dataset contains 73 columns covering demographics, remote work frequency, perceived productivity, and time use metrics. A preliminary analysis was run to evaluate a few measurable questions that could be used in exploratory data analysis (EDA) in order to gauge

# The Impact of Remote Work on Work-Life Balance and Productivity

Ahmed Khan

INST414

[Github Repository](#)

employee job satisfaction with a variety of metrics. 10 columns of the 73 were utilized for data processing to run initial hypothesis testing as well as a full analysis. The 10 columns selected vary in data but all relate to remote work. The columns vary from how much of a user's work time is spent remote vs. in-office, how much they'd prefer to work remote, how well they can work with coworkers in remote environments, their self-reported productivity, prep time, personal time, and work time for both in-office and remote.

Utilizing python, a multitude of steps were taken to re-organize and preprocess the data in order to run tests on the data. After importing the data into a python notebook, all columns, which in the raw dataset are questions, were standardized for python by replacing all empty spaces with underscores. Then, identified key columns to be used in EDA were extracted into a new dataframe, `df_filtered`. In order for the data to be readable, the massive column titles, questions were renamed into shorter, readable categories, such as "on a day when you do remote work, how many hours would you spend doing the following activities preparing for work and commuting" into "remote prep commute time". Next, major preprocessing was required as EDA relies on numeric data, however many of the answers in the dataset utilized answers directly from the survey. This posed an issue with a few of the 7 columns utilized, such as the amount of time, in percentage, was spent working remote (`current_remote_work_time`), had answers such as 90%, 20%, 50% - I spent about half of my time remote working, or 100% - I spent all of my time remote working, this posed several issues with processing in python. In order to effectively run an analysis on the data, many of the columns were reorganized into entirely numerical data columns. This was done utilizing mapping in order to change text based answers into numerical answers. A specific example of this is within the `remote_work_productivity` column, focused on

## The Impact of Remote Work on Work-Life Balance and Productivity

Ahmed Khan

INST414

[Github Repository](#)

how productive an employee feels working remotely when compared to being in the office. The answers in this column were entirely written such as “I’m 50% more productive when working remotely” being mapped to a value of 1.5, 50% higher than the productivity they have at work, being a 1. With productivity below the in-person work being below a 1. This was done with every column, such as changing a column scaling from strongly disagree to strongly agree to a 1-5 scaling.

With preliminary changes complete, data cleaning could commence, focusing on removing rows with massive outliers, in order to prevent skewed data. When running preliminary analyses on the dataset, there were answers in a few of the numerical columns that were nonsensical. For example, some survey answers by employees indicated they work a staggering 20 hours a day while having 6 hour commute times which were both incredibly unrealistic and would jeopardize the research being conducted with skewed results. In order to identify the outliers mentioned, box and whisker plots were coded and all rows containing outlier data were completely removed from the dataset. From 1507 rows, the dataset was reduced to 899 participants.

With the dataset removed of massive outliers, further cleaning was necessary before running an analysis. The filtered dataset was checked for null fields across all 10 columns and 899 rows. There were a total of 287 null fields across 3 columns discovered which were then filled in utilizing the median of each respective column. Medians provide better “typical” values and are robust to outliers, making it a strong method for filling in null fields. Furthermore, removing up to 287 more rows would make the sample size incredibly small and in order to preserve sample size the null fields were filled in as opposed to being removed.

## Analytical Approach

In order to thoroughly analyze the data, a formulated hypothesis must be formed in order to be tested on.

### *Observation:*

Work-life balance plays an important role in satisfaction and productivity in employees. Remote work has grown in popularity over the past few years but whether it improves work-life balance is still a question.

An observation was noted, and through it, hypothesis statements were formed.

### *Hypothesis Statements:*

Null Hypothesis ( $H_0$ ): Working from home doesn't significantly improve work-life balance compared to working in-office.

Alternative Hypothesis ( $H_A$ ): Working from home leads to a significant improvement in work-life balance compared to working in-office.

With a hypothesis to be tested formed, a viable hypothesis testing method must be utilized in order to effectively determine whether the alternative hypothesis can be accepted or rejected.

First, 2 columns were selected to be tested, remote work personal time and office work personal time. These 2 columns are how much time, in hours, an employee gets when working a day

remote or working a day in the office. A paired t-test was selected as the 2 samples being tested are from the same row. However, after running preliminary assumption tests, it was determined the t-test could not be run, as noted in the code. The normality of the curve was not met. This leads to the use of a wilcoxon-signed rank test. The most important assumption of the wilcoxon-signed rank test is that the test assumes that the differences between paired samples are distributed normally, however, it was discovered that the normality was not met when viewing the data in a histogram format. As a result, a simple Sign Test, which does not require a normality assumption was used to test the hypothesis

## **Further Analysis**

With a hypothesis tested, further analysis is necessary using advanced analytical techniques. In order to properly utilize the many different columns with different, important, aspects of remote work that can be integral to understanding WFH viability. In order to do so, a multiple linear regression model must be made. A multiple linear regression model is the best choice of action as it tests the effect of multiple statistics on the same dependent variable, in this case, remote work productivity. The multiple linear regression utilized self-reported work productivity, “remote\_work\_productivity” as a dependent variable, and examined the effect many other columns had on it. The columns used as independent variables were current\_remote\_work\_time (the amount of time currently spent working remote), remote\_collaboration\_ease (scale of 1-5 how easy it is to work with coworkers remotely), personal\_time\_diff (a new column made to evaluate the difference in personal time during a day working from home taken out of the personal time during a day working in-office),



prep\_commute\_time\_diff (a new column taking the difference from remote prep time and in-office prep time).

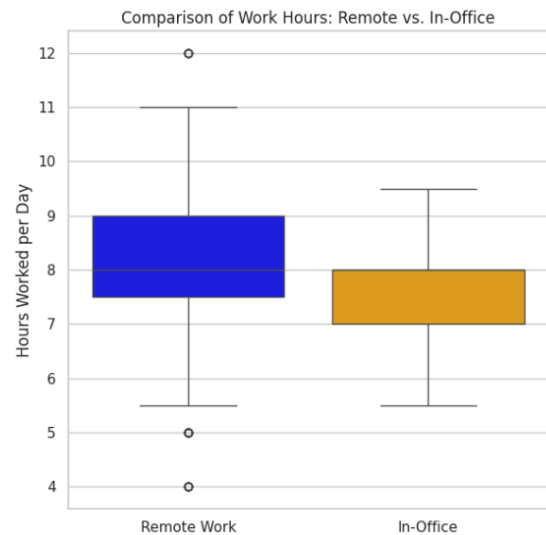
## Results and Discussion

### Descriptive Statistics

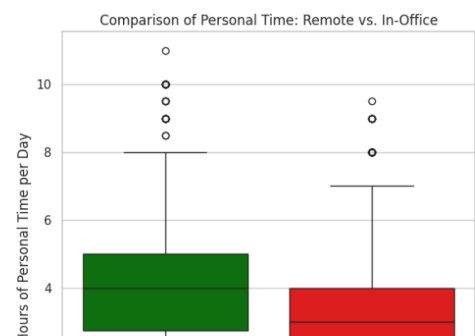
After cleaning the datasets thoroughly, a multitude of important data from the descriptive statistics can be found that could be related to remote work productivity and viability. First, 73% of participants worked remotely at the time, however, only 55% preferred to work remotely at the time, this can be in line with the constraints of the COVID-19 pandemic.

This suggests that at the time, employees actually preferred to be in-office opposed to at home.

As mentioned earlier, the data could be skewed as a result of COVID-19 pandemic restrictions making employees desire more human interaction with in-office working



*Figure 1A*



# The Impact of Remote Work on Work-Life Balance and Productivity

Ahmed Khan

INST414

[Github Repository](#)

than normally as a result of quarantine procedures. When comparing initial commute and prep time in-office vs. remote, there is a 1.2 hours of saving as in-office prep time averages to 1.56 while remote hours averages to 0.36. Finally, remote work days tend to offer more personal time per day on average vs.

Figure 1B

in-office days (~0.9 hours). This is all further propagated by Figures 1A-1C showing higher personal time

Figure 1C

and lower prep time on remote days. The histogram in Figure 2 suggests most participants rated productivity when working remotely to be equal to or slightly higher than in-office work.

## Hypothesis Testing

After running assumption tests for a paired t-test and wilcoxon-signed rank test. A Sign Test was run to reject or accept the null hypothesis. The Sign Test resulted in a p-value of  $1.22 \times 10^{-72}$ , demonstrating a significantly smaller than 0.05 p-value.

This indicates a rejection of the null hypothesis ( $H_0$ ),

working from home doesn't significantly improve work-life balance compared to working in-office, thus accepting the alternative hypothesis ( $H_A$ ), working from home leads to a significant improvement in work-life

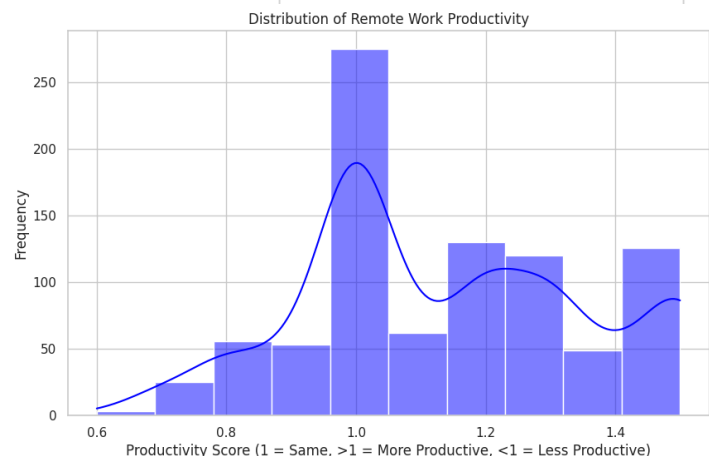
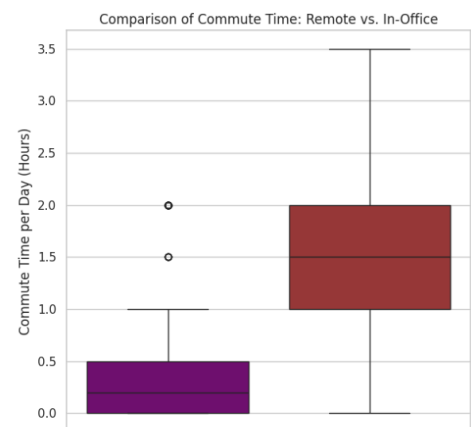


Figure 2

OLS Regression Results			
Dep. Variable:	remote_work_productivity	R-squared:	0.048
Model:	OLS	Adj. R-squared:	0.044
Method:	Least Squares	F-statistic:	11.32
Date:	Sun, 27 Apr 2025	Prob (F-statistic):	5.75e-09
Time:	16:50:14	Log-Likelihood:	103.67
No. Observations:	899	AIC:	-197.3
Df Residuals:	894	BIC:	-173.3
Df Model:	4		
Covariance Type:	nonrobust		

balance compared to working in-office. The test indicates that the increase of personal time from remote work is statistically significant.

## Regression Results

The multiple linear regression (MLR) performed provided many intriguing results. The MLR suggests that

*Figure 3*

ease of collaboration, how easy it is to collaborate with co-workers, is the most significant predictor for improved productivity when WFH. Further, percent time spent working remotely is also a minimal predictor of productivity. From the regression, for every 10% increase in time worked remotely there was approximately 0.77% unit increase in self-reported productivity perception. For each point increase in collaboration ease (1-5) there is an approximate 4.2% increase in self-reported productivity.

## Interpretations

Findings from the data analysis support initial literature reviews such as Bloom et al. and Wang et al. that remote work can increase productivity and satisfaction. However, unlike Bloom's experimental designs, this study is survey-based and may reflect optimistic self-perceptions. Regardless, collaboration quality emerges to be a major driving factor, as mentioned in research by Wang, suggesting an emphasis on managerial support and digital tools.

## Limitations & Implications

During the completion of this research, there are a multitude of limitations and implications that arise. Firstly, a consideration must be made and kept in mind. Self-reported biases are incredibly possible as participants may be exaggerating reported productivity, especially without objective employer data. This may be a negative cause and limitation in the

# The Impact of Remote Work on Work-Life Balance and Productivity

Ahmed Khan

INST414

[Github Repository](#)

research conducted, however, while objective evaluations are important, when considering the research question, the most important concept to evaluate is an employee's perceived satisfactions, opposed to objective satisfactions. If the employee feels like remote work is an improvement for them, then the research question is being answered.

Other limitations include sample bias. The current sample utilizes a survey done entirely on governmental employees within one population, during the COVID-19 pandemic quarantine. This could cause a bias in the data as it does not represent the entire population. Further, the COVID-19 pandemic caused a lot of issues and problems for individuals and may have changed their answer to certain questions that they may not have the same feelings towards in current, less restrictive, times. This could be viewed in a column such as one in which it asks participants to state how often they'd like to currently work remotely vs. how much they currently do. During the pandemic, many people were working much more remotely than they'd like to, this could be a much different dataset in current time, 5 years later.

Finally, as mentioned before, is objective employer data. Without objective employer data analytically viewing work performance metrics there isn't entirely a way to view remote work as an objectively significant improvement in the work performance side of things.

From the research completed, it is clear that when it comes to remote work, employers should strongly consider collaboration and remote access tools as well as provide optional remote and/or hybrid flexibility in order to boost employee morale and reduce burnout.

## Conclusions & Future Work

Remote work improves work-life balance primarily through more personal time and less commuting. Productivity of employees benefits most from collaborative efforts and ease. While

# The Impact of Remote Work on Work-Life Balance and Productivity

Ahmed Khan

INST414

[Github Repository](#)

current findings are encouraging, there is a multitude of research into a variety of topics that could provide deeper insight than currently discovered. Employer performance long visualizing or providing datasets comparing employee performance metrics during remote work periods and during in-office periods would provide better insights into objective performance of employees in remote work vs. in-office work. Research into hybrid vs. full-remote jobs could provide further insight into how effective a hybrid work environment can be when it comes to maximizing productivity.

## Annotated Bibliography

Attri, Ashwani Kumar, and Gagandeep Kaur. "Impact of technology on work life balance of remote workers: An empirical study using UTAUT model." *AIP Conference Proceedings*, vol. 2782, 2023, p. 020110, <https://doi.org/10.1063/5.0154447>.

*Annotation:* This paper discusses the impact of technology on work-life balance of remote workers in India utilizing statistical methodology.

Bloom, N., Liang, J., Roberts, J., & Ying, Z. J. (2015). Does Working from Home Work? Evidence from a Chinese Experiment. *The Quarterly Journal of Economics*, 130(1), 165–218. <https://doi.org/10.1093/qje/qju032>

*Annotation:* This paper discusses research conducted via randomized controlled trials to examine the impact of remote work on employee productivity and satisfaction within a Chinese travel agency.

Gajendran, R. S., & Harrison, D. A. (2007). The good, the bad, and the Unknown about telecommuting: Meta-analysis of Psychological Mediators and Individual consequences.

*Journal of Applied Psychology*, 92(6), 1524–1541.

<https://doi.org/10.1037/0021-9010.92.6.1524>

*Annotation:* This paper provides a meta-analysis and synthesizes findings from multiple studies related to telecommuting, highlighting the positive and negative effects of remote work such as increased autonomy or work-family conflicts.

Gibbs, Michael, et al. “Work from home and productivity: Evidence from personnel and analytics data on Information Technology Professionals.” *Journal of Political Economy Microeconomics*, vol. 1, no. 1, 1 Feb. 2023, pp. 7–41, <https://doi.org/10.1086/721803>.

*Annotation:* This paper investigates the relationship between employee productivity and WFH in a company from India. Employs statistical methods in order to calculate and compare productivity metrics before and after WFH implementations.

Golden, T. D., & Veiga, J. F. (2005). *THE ROLE OF VIRTUAL WORK IN UNDERSTANDING THE IMPACT OF SUPERVISORY RELATIONSHIPS*. *Academy of Management Proceedings*, 2005(1), K1–K5. <https://doi.org/10.5465/ambpp.2005.18780645>

*Annotation:* This paper examines the relationship between the degree of remote work and job satisfaction by mathematically evaluating the relationship between the two finding a curvilinear relationship that provides insight into how much remote work yields the highest job satisfaction and providing evidence that there is a plateau to how much satisfaction is obtained from remote work.

Prasad, KDV, and VK Satyaprasad. “The relationship between remote working and work-life balance with mediating and moderating effects of social support: An empirical study of

information technology employees.” *International Journal of Organizational Leadership*, vol. 0, no. 0, 15 July 2023, pp. 235–253, <https://doi.org/10.33844/ijol.2023.60366>.

*Annotation:* This paper investigates the effects of social support on remote work and work-life balance and utilizes statistical methods in order to identify that an increase in social support results in improved work-life balance.

Wang, B., Liu, Y., Qian, J., & Parker, S. K. (2021). Achieving Effective Remote Working during the COVID-19 pandemic: a Work Design Perspective. *Applied Psychology*, 70(1), 16–59. Wiley. <https://doi.org/10.1111/apps.12290>

*Annotation:* This paper investigates work design factors that can create effective remote work during the pandemic utilizing survey data and semi-structured interviews to get insight from employees of WFH. The paper discusses key aspects such as management support as well as task design as important factors towards beneficial remote work. Further, it discusses negative effects of remote work as cited by employees in various interviews and surveys.