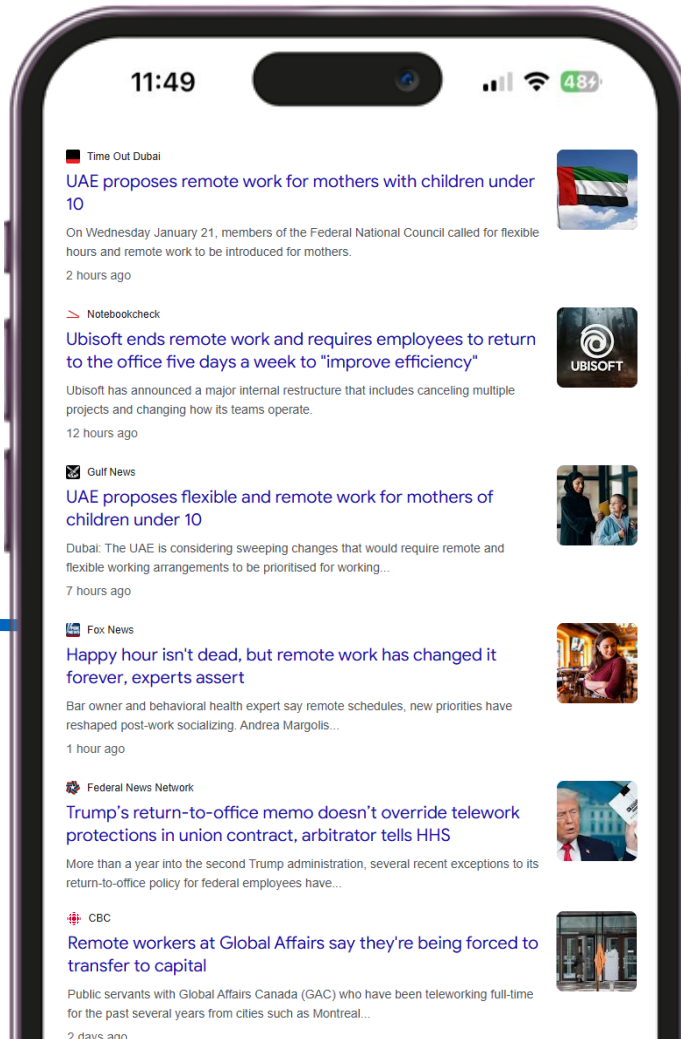# Impact of Remote Work Frequency on Employee Well-Being
Telling Stories in R

23.01.2026 Final Presentation

Remote & Hybrid-Work is considered a hot topic...

Time Out Dubai

UAE proposes remote work for mothers with children under 10

On Wednesday January 21, members of the Federal National Council called for flexible hours and remote work to be introduced for mothers.

2 hours ago

Notebookcheck

Ubisoft ends remote work and requires employees to return to the office five days a week to "improve efficiency"

Ubisoft has announced a major internal restructure that includes canceling multiple projects and changing how its teams operate.

12 hours ago

Gulf News

UAE proposes flexible and remote work for mothers of children under 10

Dubai: The UAE is considering sweeping changes that would require remote and flexible working arrangements to be prioritised for working...

7 hours ago

Fox News

Happy hour isn't dead, but remote work has changed it forever, experts assert

Bar owner and behavioral health expert say remote schedules, new priorities have reshaped post-work socializing. Andrea Margolis...

1 hour ago

Federal News Network

Trump's return-to-office memo doesn't override telework protections in union contract, arbitrator tells HHS

More than a year into the second Trump administration, several recent exceptions to its return-to-office policy for federal employees have...

CBC

Remote workers at Global Affairs say they're being forced to transfer to capital

Public servants with Global Affairs Canada (GAC) who have been teleworking full-time for the past several years from cities such as Montreal...

2 days ago

TUM

„*The COVID-19 pandemic triggered the largest experiment in remote work in history.*"

OECD (2021)

Why Does **Remote Work Frequency** Matter?

Research Questions

? How did **remote work change** before, during and after COVID-19?

? How is **remote work frequency** associated with **employee well-being** outcomes?

Source: https://news.stanford.edu/stories/2024/06/hybrid-work-is-a-win-win-win-for-companies-workers

Distribution of Remote Work Frequency in Europe

01 Data

TIME	2015	2016	2017	2018
GEO				
European Union - 27 countries (from 2020)	4.9	4.8	5.1	5.2
Euro area – 21 countries (from 2026)	5.1	5.0	5.5	5.6
Belgium	8.1	7.2	6.9 (b)	6.6
Bulgaria	0.3 (u)	0.2 (u)	0.3 (u)	0.3 (u)
Czechia	3.5	3.8	3.9	4.8
Denmark	9.0	8.4 (b)	8.8 (b)	7.8
Germany	3.3	3.2	4.8	5.0
Estonia	5.4	5.8	5.7	7.4
Ireland	3.7	3.3	5.0 (b)	6.5
Greece	2.6	2.6	2.3	2.0
Spain	3.6	3.5	4.3	4.3
France	7.0	6.9	6.7	6.6
Croatia	1.2	1.5	1.5	1.4
Italy	3.4	3.3	3.5	3.6 (b)
Cyprus	1.5	1.6	1.2	1.2
Latvia	2.1	2.6	2.1	2.9
Lithuania	3.0	2.7	2.6	2.5
Luxembourg	13.2 (b)	12.0	12.7	11.0
Hungary	3.4	3.0	2.5	2.3 (b)
Malta	2.6	3.6	4.4	5.9
Netherlands	13.6	13.4	13.7	14.0
Austria	10.2	9.9	9.5	10.0
Poland	5.6	5.3	4.5	4.6
Portugal	6.2	6.3	5.9	6.1
Romania	0.5	0.5	0.4	0.4

02 Key Facts

36
European countries

3
Frequency categories

Annual data
since 1992

03 Data Cleaning Process

Data Collection → Data Cleaning → Data Processing → Data Visualization

- data collection from the official Eurostat website
- removed missing values
- reshaped data structure
- created relevant variables
- selected appropriate visualization type

Economic Development in Europe

TUM

01 Data

Country	2015-Q1	2015-Q2	2015-Q3
Belgium	0,6	-0,1	0,1
Bulgaria	0,1	-0,2	0,5
Czechia	-1,8	1,4	1,2
Denmark	0,4	0,4	0,3
Germany	0,3	0,5	-0,2
Estonia	-1,4	-0,2	2,8
Ireland	-0,9	1,6	0,4
Greece	-5,4	0,1	1,1
Spain	0,0	1,4	1,0
France	0,0	-0,1	0,2
Croatia	-0,7	-1,4	1,4
Italy	-0,4	0,4	0,2
Cyprus	0,3	0,9	1,0
Latvia	0,5	0,3	-0,7
Lithuania	1,9	1,0	-0,4
Luxembourg	0,5	0,9	0,4
Hungary	0,1	0,0	1,6
Malta	-0,8	4,2	-2,6
Netherlands	-0,4	0,3	0,9
Austria	-2,4	1,1	0,9
Poland	-0,2	1,3	0,6
Portugal	-1,0	2,1	0,1
Romania	-2,3	1,7	0,6

https://www.oecd.org/en/data/indicators/gdp-per-hour-worked.html

02 Key Facts

36 European countries

1 Variable

Quarterly data since 1995

03 Data Cleaning Process
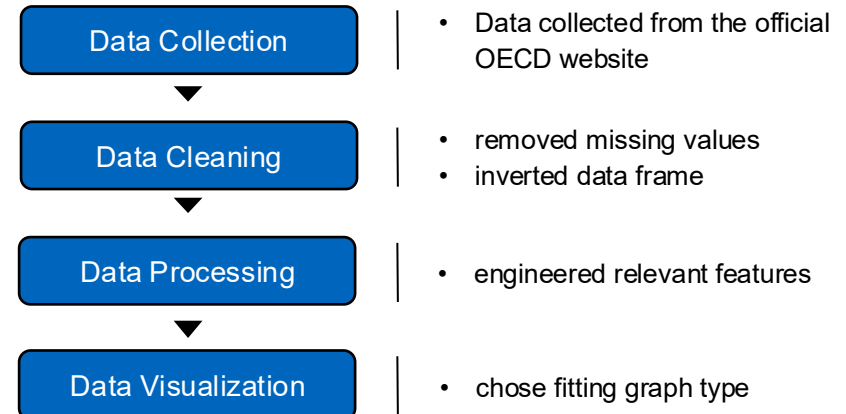
Data Collection — • Data collected from the official OECD website

Data Cleaning — • removed missing values • inverted data frame

Data Processing — • engineered relevant features

Data Visualization — • chose fitting graph type

Remote Work Increased **Significantly** During COVID-19

TΙΠ

Remote Work Trend and Working Hours Volatility in Europe

Comparing european remote work trends with changes in average hours worked
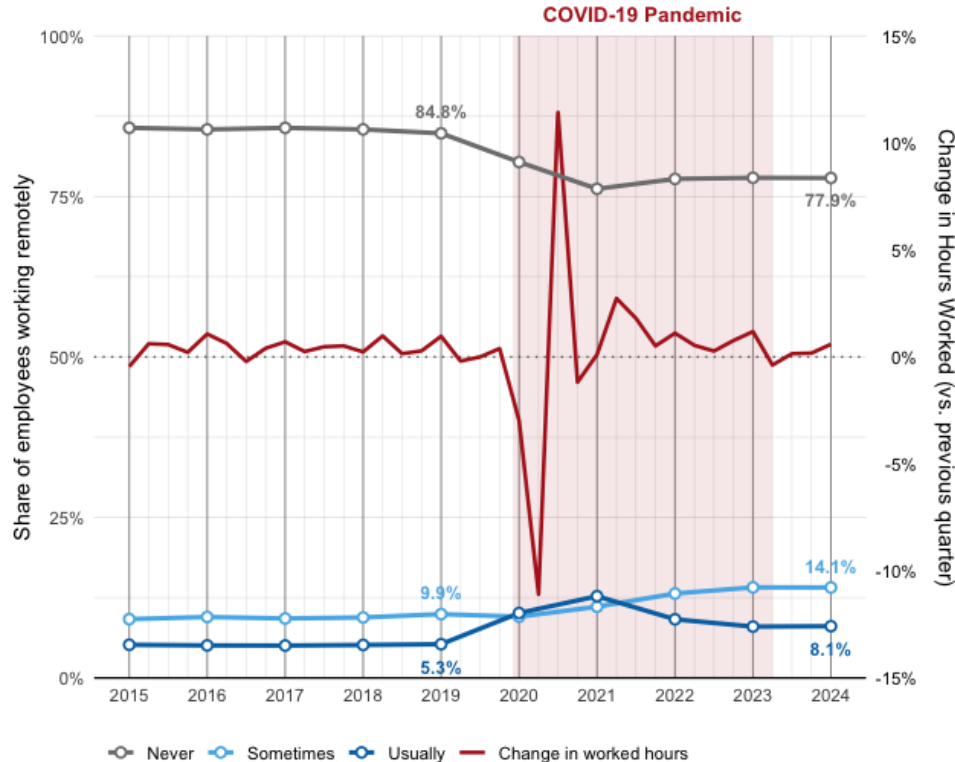
Key Messages

1 **Remote work** adoption **increased** sharply during the COVID-19 pandemic.

2 The **share of employees** usually working remotely **more than doubled** between 2019 and 2021.
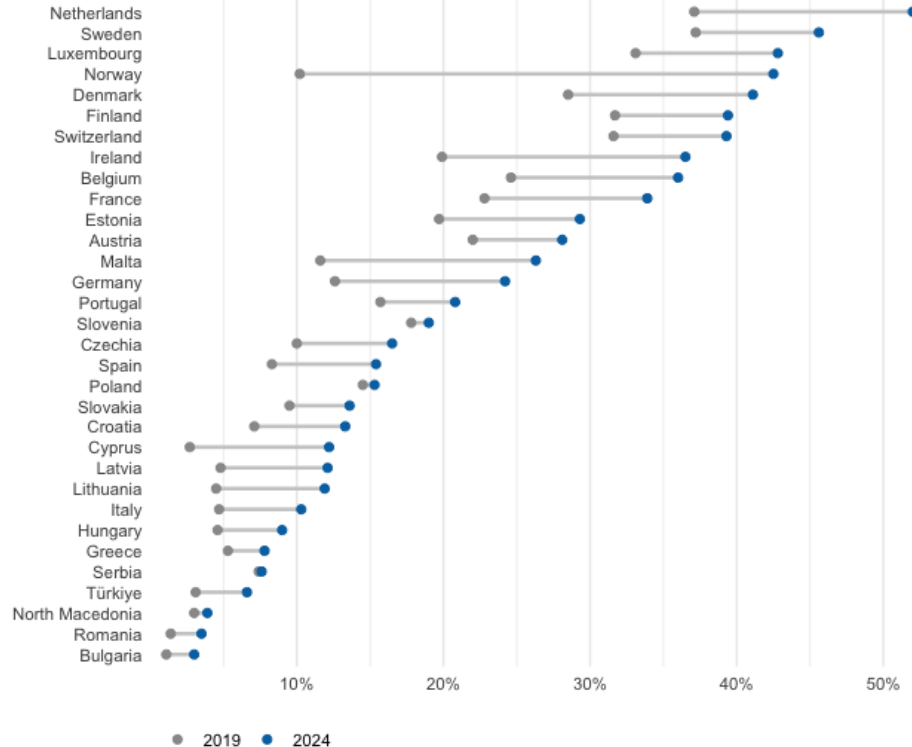
3 Despite **economic volatility**, **remote work** levels **remained elevated** after the pandemic.

Remote Work Increased **Significantly** During COVID-19

TUΠ

Remote Work Adoption by Country (2019 vs. 2024)
Comparison of pre and post-pandemic share of employees working from home

● 2019 ● 2024

Key Messages

1 Almost all European countries saw a **substantial jump in remote work adoption** from 2019 to 2024.

2 **Post-pandemic remote work** shares **remain** significantly **higher** than pre-COVID levels.

3 Generally, countries with **higher pre-COVID levels** saw a **greater increase** than countries with a lower level before the pandemic.

8

Combining **Remote Work** and **How We Feel**

01 Data

	Job_Role	Work_Arrangement	Hours_Per_Week	Mental_Health_Status	Burnout_Level	Work_Life_Balance_5
1	Data Analyst	Onsite	64	Stress Disorder	High	3
2	Data Analyst	Onsite	37	Stress Disorder	High	4
3	Business Analyst	Onsite	36	ADHD	High	3
4	Data Analyst	Onsite	63	ADHD	Medium	1
5	DevOps Engineer	Hybrid	65	None	Medium	5
6	Business Analyst	Onsite	61	Burnout	Medium	4
7	IT Support	Onsite	62	None	Medium	4
8	Technical Writer	Onsite	55	Anxiety	High	3
9	Software Engineer	Remote	47	Anxiety	Medium	2
10	HR Manager	Onsite	55	Burnout	Medium	5
11	Project Manager	Onsite	38	None	High	3
12	Business Analyst	Remote	35	ADHD	Medium	3

Post Pandemic Remote Work Health Impact 2025

02 Key Facts

3157 survey respondents

14 variables

June 2025 date of survey

5 regions

03 Data Dimensions

Demographics

Job Information

Well-Being Statistics

04 Data Cleaning Process

Data Collection
- collected & loaded data from Kaggle

Data Cleaning
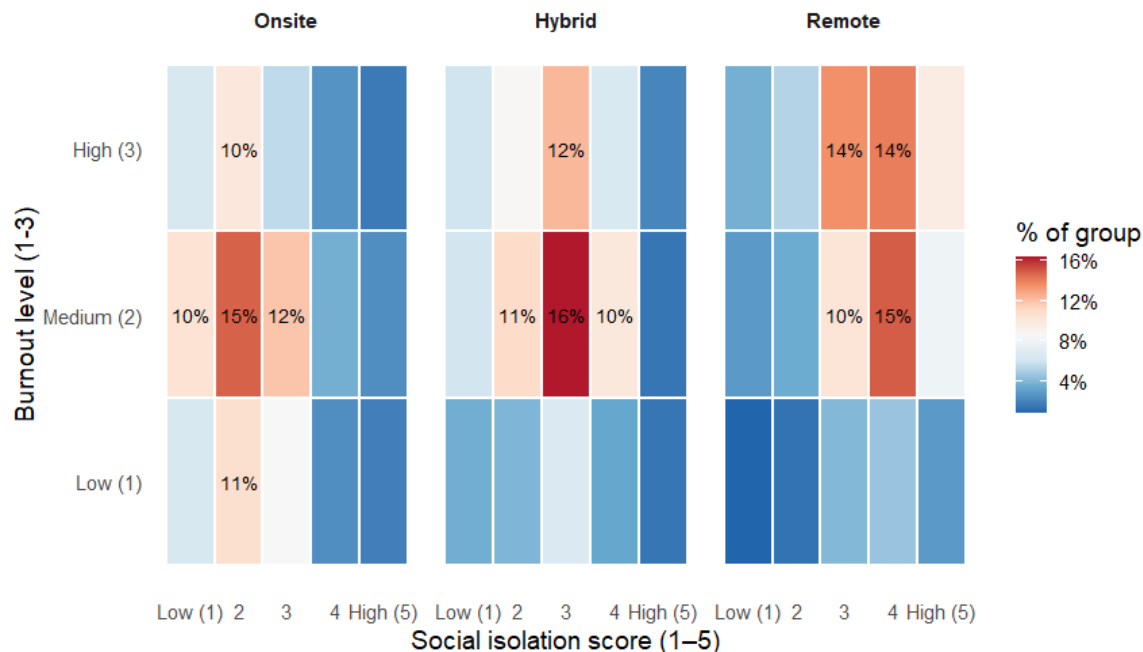- removed duplicates
- removed missing data

Data Processing
- selected relevant variables
- encoded categorical variables

Social Isolation & Burnout **Differ Significantly by Work Arrangement**

Work arrangement and its influence on Isolation vs. Bournout

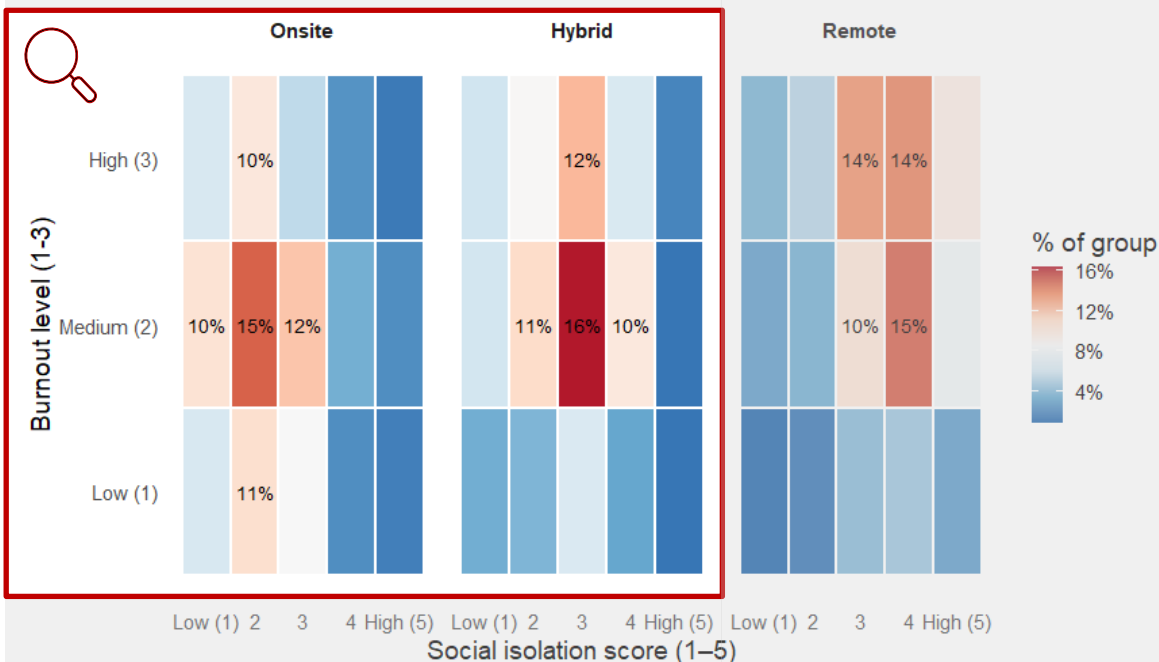Each tile shows the share of people within that work arrangement

Key Messages

1 **Onsite workers** report **lower social isolation** compared to other work arrangements.

2 **Hybrid workers** mostly show **medium isolation scores** and **medium burnout levels.**

3 **Fully remote workers** exhibit **higher social isolation** and the **highest burnout levels** across all groups.

10

Social Isolation & Burnout Differ Significantly by Work Arrangement

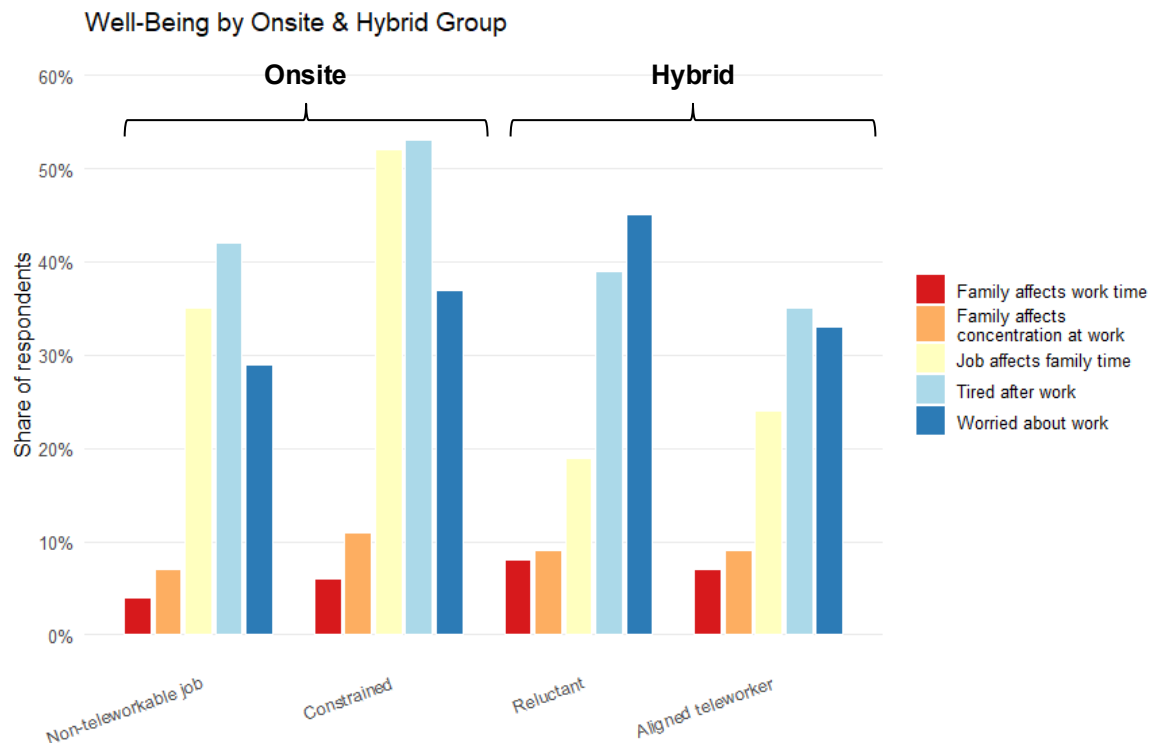Work arrangement and its influence on Isolation vs. Bournout
Each tile shows the share of people within that work arrangement

Key Messages

1. **Onsite workers** report **lower social isolation** compared to other work arrangements.

2. **Hybrid workers** mostly show **medium isolation scores** and **medium burnout levels.**

3. **Fully remote workers** exhibit **higher social isolation** and the **highest burnout levels** across all groups.

On-Site & Hybrid Workers Satisfaction Differs by Type ПШ

Well-Being by Onsite & Hybrid Group

Onsite   **Hybrid**

Share of respondents

Legend:
- Family affects work time
- Family affects concentration at work
- Job affects family time
- Tired after work
- Worried about work

Categories: Non-teleworkable job, Constrained, Reluctant, Aligned teleworker

Key Messages

1   **Employees in non-teleworkable jobs are less worried about work.** Family affects work less.

2   **People, who want to work remote,** but **cannot** have the **highest dissatisfaction scores** in almost every category.

3   **Reluctant Teleworkers are more worried & stressed** about their **job, while aligned teleworkers** have **highest satisfaction score.**

12

Constrained = People who want to work remote but can't | Reluctant = People who can work remote but refuse | Aligned = People who can partly work remote and make use of it

Lessons Learned

Key Insights from the Analysis

- **Rising remote work** showed **no effect on productivity.**

- **Hybrid work** shows more **balanced well-being** outcomes.

- **Work arrangement** affects **isolation** and **burnout probability.**

Methodological Findings

- **Merge datasets** only when it serves a clear **analytical purpose.**

- Apply a structured **data-cleaning process** to **avoid misleading visualizations.**

- Prefer **relative measures over absolute values** to better illustrate **trends and distributions.**

Source: https://news.stanford.edu/stories/2024/06/hybrid-work-is-a-win-win-win-for-companies-workers

Our Team

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Thank You!

Group 8 – Felix Pütterich, Lucas Tuchen, Nina Bauer

23.01.2026

Plot 1

```r
average_trend <- remote_work_full %>%
  group_by(Year, Frequency) %>%
  summarise(Avg_Percentage = mean(Percentage, na.rm = TRUE), .groups = "drop")

hours_trend <- hours_worked_quarterly %>%
  group_by(Year, Quarter, Year_Quarter_Num) %>%
  summarise(Hours_Change = mean(Hours_Change, na.rm = TRUE), .groups = "drop") %>%
  filter(Year_Quarter_Num <= 2024.0)

# scaling for secondary axis
offset <- 50
scale_factor <- 50 / 15

quarterly_breaks <- seq(2015, 2024, by = 0.25)

label_data <- average_trend %>%
  filter(Year %in% c(2019, 2024)) %>%
  mutate(
    vjust_pos = case_when(
      Year == 2019 & Frequency %in% c("Never", "Sometimes") ~ -1.2,
      Year == 2019 & Frequency == "Usually" ~ 2.2,
      Year == 2024 & Frequency == "Sometimes" ~ -1.2,
      Year == 2024 & Frequency %in% c("Never", "Usually") ~ 2.2,
      TRUE ~ -1.5
    )
  )

# viziualizing the data
ggplot() +
  annotate("rect",
           xmin = 2019.917, xmax = 2023.25,
           ymin = 0, ymax = 100,
           alpha = 0.1, fill = "firebrick") +

  annotate("text",
           x = 2021.5835,
           y = 100,
           vjust = -1,
           label = "COVID-19 Pandemic",
           color = "firebrick", fontface = "bold", size = 4) +

  geom_hline(yintercept = offset, linetype = "dotted", color = "grey40") +
  annotate("text", x = 2015.2, y = offset + 2, label = NULL,
           color = "grey40", size = 3, fontface = "italic", hjust = 0) +

  # hours worked line
  geom_line(data = hours_trend,
            aes(x = Year_Quarter_Num,
                y = Hours_Change * scale_factor + offset,
                color = "Hours Worked Change (Quarterly)"),
            linewidth = 1) +

  # remote work lines and points
  geom_line(data = average_trend,
            aes(x = Year, y = Avg_Percentage, color = Frequency),
            linewidth = 1.2) +

  geom_point(data = average_trend,
             aes(x = Year, y = Avg_Percentage, color = Frequency),
             size = 2, shape = 21, fill = "white", stroke = 1) +

  # data point labeling
  geom_text(data = label_data,
            aes(x = Year, y = Avg_Percentage, color = Frequency,
                label = label_number(accuracy = 0.1, suffix = "%")(Avg_Percentage),
                vjust = vjust_pos),
            fontface = "bold", size = 3.5, show.legend = FALSE) +

  scale_x_continuous(
    breaks = seq(2015, 2024, by = 1),
    minor_breaks = quarterly_breaks
  ) +

  scale_y_continuous(
    name = "Share of employees working remotely",
    labels = label_number(suffix = "%"),
    expand = c(0, 0),
    limits = c(0, 100),
    sec.axis = sec_axis(~ (. - offset) / scale_factor,
                        name = "Change in Hours Worked (vs. previous quarter)",
                        labels = label_number(suffix = "%", accuracy = 1))
  ) +

  coord_cartesian(ylim = c(0, 100), clip = "off") +

  scale_color_manual(values = c("Never" = "grey50",
                                "Sometimes" = "#56B4E9",
                                "Usually" = "#0072B2",
                                "Hours Worked Change (Quarterly)" = "firebrick"),
                     labels = c("Hours Worked Change (Quarterly)" = "Change in worked hours")) +

  labs(
    title = "Remote Work Trend and Working Hours Volatility in Europe",
    subtitle = "Comparing european remote work trends with changes in average hours worked",
    x = NULL,
    color = NULL
  ) +

  theme_minimal(base_size = 12) +
  theme(
    panel.grid.major.x = element_line(color = "grey60", linewidth = 0.4),
    panel.grid.minor.x = element_line(color = "grey90", linewidth = 0.2),
    panel.grid.major.y = element_line(color = "grey85", linewidth = 0.2),
    axis.line.x = element_line(color = "black", linewidth = 0.5),

    legend.position = "bottom",
    legend.justification = "left",

    axis.title.y.right = element_text(color = "black", margin = margin(l = 10)),
    axis.text.y.right = element_text(color = "black"),

    plot.title = element_text(face = "bold"),
    plot.subtitle = element_text(margin = margin(b = 30), color = "grey30"),
  )
```

Parts of the code were developed with the support of ChatGPT.

Plot 2

```r
# prepare data
comparison_data <- remote_work_full %>%
  filter(Frequency != "Never") %>%
  group_by(Country, Year) %>%
  summarise(Total_Remote = sum(Percentage, na.rm = TRUE), .groups = "drop") %>%
  filter(Year %in% c(2019, 2024)) %>%
  pivot_wider(names_from = Year, values_from = Total_Remote, names_prefix = "Y") %>%
  drop_na(Y2019, Y2024) %>%
  filter(!str_detect(Country, "Euro")) %>%
  filter(Y2024 > 0) %>%
  filter(Y2019 > 0)

# vizualize data
ggplot(comparison_data, aes(y = reorder(Country, Y2024))) +

  geom_segment(aes(x = Y2019, xend = Y2024, yend = Country),
               color = "grey80", size = 1) +

  geom_point(aes(x = Y2019, color = "2019"), size = 2) +

  geom_point(aes(x = Y2024, color = "2024"), size = 2) +

  scale_color_manual(
    name = NULL,
    values = c("2019" = "grey60", "2024" = "#0072B2"),
    breaks = c("2019", "2024")
  ) +

  scale_x_continuous(labels = label_number(suffix = "%"), expand = c(0, 1)) +

  labs(
    title = "Remote Work Adoption by Country (2019 vs. 2024)",
    subtitle = "Comparison of pre and post-pandemic share of employees working from home",
    x = NULL,
    y = NULL
  ) +

  theme_minimal(base_size = 12) +
  theme(
    legend.position = "bottom",
    legend.justification = "left",

    panel.grid.major.y = element_blank(),
    plot.title = element_text(face = "bold"),
    plot.subtitle = element_text(color = "grey30")
  )
```

Parts of the code were developed with the support of ChatGPT.

Plot 3

```r
#5.Create Plot
#5.1 Label Tiles above 10% share
heat <- heat %>%
  mutate(label = if_else(pct >= 0.10, percent(pct, accuracy = 1), ""))
#5.2 Start Creating Plot with right axes & plot type
ggplot(heat, aes(x = Social_Isolation_Score, y = Burnout_Score, fill = pct)) +
  geom_tile(color = "white", linewidth = 0.8) +
  geom_text(aes(label = label), size = 3.6) +
  facet_grid(~ Work_Arrangement) +
  scale_x_continuous(breaks = 1:5, labels = c("Low (1)", "2", "3", "4", "High (5)")) +
  scale_y_continuous(
    breaks = 1:3,
    labels = c("Low (1)", "Medium (2)", "High (3)")
  ) +
#5.3 Add right color filling
  scale_fill_distiller(
    palette = "RdBu",
    direction = -1,
    name = "% of group",
    labels = percent_format(accuracy = 1)
  ) +
#5.4 Make Title Subtitle and x and y legend
  labs(
    title = "Work arrangement and its influence on Isolation vs. Bournout",
    subtitle = "Each tile shows the share of people within that work arrangement",
    x = "Social isolation score (1-5)",
    y = "Burnout level (1-3)"
  ) +
  #5.5 Add nice-looking| theme
  theme_minimal(base_size = 14) +
  theme(
    plot.title = element_text(face = "bold"),
    panel.grid = element_blank(),
    strip.text = element_text(face = "bold")
  )
```

Parts of the code were developed with the support of ChatGPT.