Institut Mines-Télécom Business School

MSc in Management of Innovation in the Digital Economy

Tech Layoffs 2020-2024

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Table of Contents:

I. Introduction

1.1 Tech Industry Overview

The ever-evolving technology industry has been instrumental in shaping the modern world, marked by continuous growth, transformative innovations, and solutions to complex challenges. Companies in this sector relentlessly pursue cutting-edge technologies that redefine how individuals, businesses, and society function, from personal computers and the internet to artificial intelligence and blockchain (Perez, 2017).

However, the rapid growth of the tech industry presents challenges for its workforce. One major concern is the inevitable rise of automation and artificial intelligence, leading to potential job displacement as companies adopt these technologies for operational improvement. Economic downturns and market shifts exacerbate these challenges, impacting the demand for tech products and services. Start-up failures, common in the industry, also contribute to employment layoffs. The dynamic nature of the tech sector, coupled with external economic factors, creates a landscape characterized by innovation but fraught with employment obstacles (Panel, 2023).

1.2 Layoffs in Tech 2020-2024

From 2020 to 2024, the tech sector faced a substantial crisis marked by widespread employee layoffs across diverse industries and company sizes. Examining the layoff data reveals an industry grappling with rapid shifts in technology demands, economic challenges, and the lingering effects of the global pandemic (Taylor & Davis, 2024).

Based on the data provided by Roger Lee *(which will evaluated and discussed further in the report),* over the past four years, an average of 267 individuals were laid off, showing significant

disruptions within tech companies. Layoffs varied widely, with some firms reducing their workforce by less than 1%, while others implemented extensive cuts, including complete workforce layoffs. The median layoff rate was 15%, signifying severe restructuring, primarily impacting North America and Asia due to their high concentration of tech hubs (Lee, 2024).

These challenging circumstances not only led to a significant decline in personnel but also signaled shifts in the technology landscape. Emerging technologies replaced old roles, automation, and AI increased efficiency at the expense of jobs, and certain industries, possibly exacerbated by the pandemic, experienced workforce shrinkage (Cuervo, 2024).

Smaller companies were particularly affected, often bearing the weight of economic instability. Employee reductions were crucial for many to extend their financial runway during low finance or market demand periods. This economic reality also prompted significant companies to swiftly respond to shareholder expectations and profit targets (Lee, 2024).

2020-2024 will be remembered as a period of adaptation and survival, highlighting the tech sector's ever-changing nature. It serves as an acknowledgment that innovation while driving growth, can also bring uncertainty to an industry at the forefront of human progress.

1.3 Research Questions

From these insights, several research questions can be derived to enhance the understanding of tech layoffs further as follows:

- How do the patterns of layoffs in the tech industry from 2020 to 2024 differ across continents?
- Does the company size correlate with layoffs during this timeframe?

II. Description of the Data

According to Roger Lee (2024), it is essential to understand the economic impacts that affect the workforce in the industry, highlighting trends and patterns that can inform businesses, policymakers, and researchers.

The dataset comprises 1418 observations and 16 variables including company name, location, country, continent, number of layoffs, data of layoffs, percentage, company size before and after layoffs, industry, stage, money raised, and geographical coordinates. Let's dive into key features including 1128 unique companies, predominantly located in the "San Francisco Bay Area" and the "USA." The dataset reflects diverse industries, with a mean layoff percentage of approximately 21.9 percent, encompassing companies of varying sizes, stages, and funding levels.

Summary	**Min.**	**1st Qu.**	**Median**	**Mean**	**3rd Qu.**	**Max**
# of Laid Off	3.0	40.0	86.0	267.4	200.00	12000.0
Company Size Before Layoffs	4	213	531	3556	1415	400000

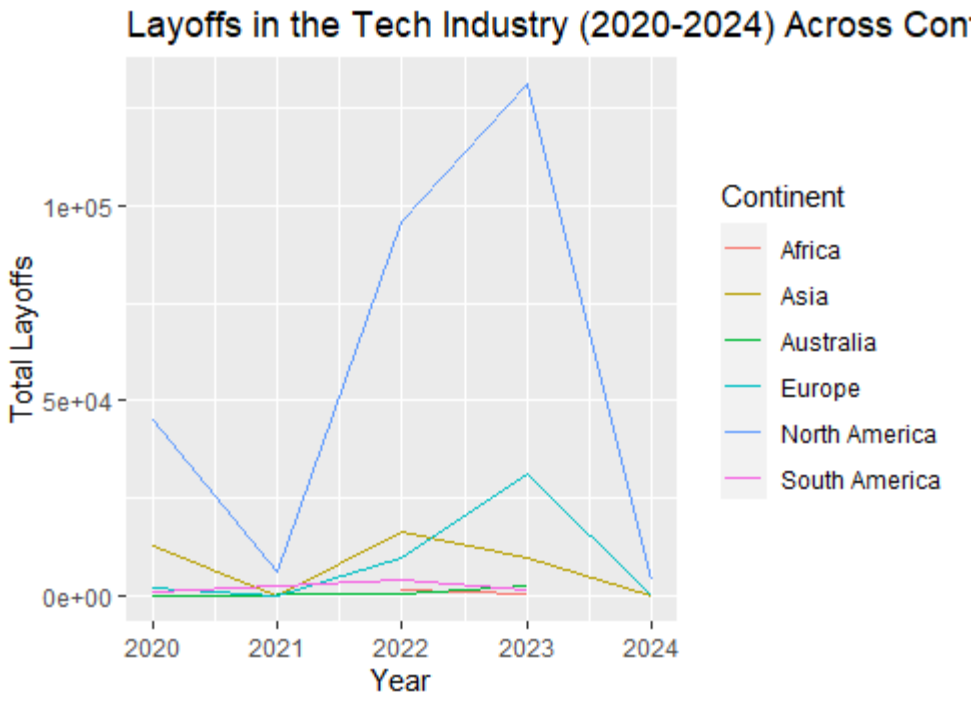
The summary of this statistic for the number of employees laid off reveals a diverse distribution, with a median of 86 and a mean of 267.4, indicating the presence of both moderate and substantial layoffs. The wide range, from 3 to 12,000 employees, suggests variability and potential outliers, with extreme cases of mass layoffs. Similarly, the company size before layoffs displays diversity, with a median of 531 and a mean of 3556. The dataset encompasses a range of companies, from small startups to large companies as evident in the board range of sizes from 4 to 400,000

employees. Overall, this dataset highlights the tech industry is diverse, with companies of different sizes and layoffs of various sizes happening.

Let's look into the below table which provides data that summarizes the total number of layoffs in the tech industry across different continents.

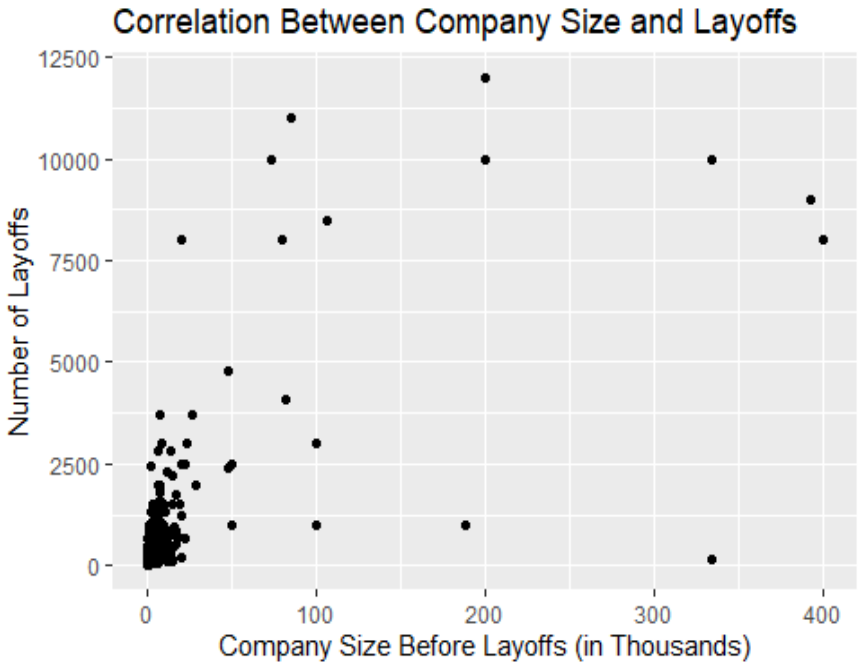
	Continent	Total_Layoffs
1	Africa	2252
2	Asia	39514
3	Australia	3629
4	Europe	43611
5	North America	282599
6	South America	7557

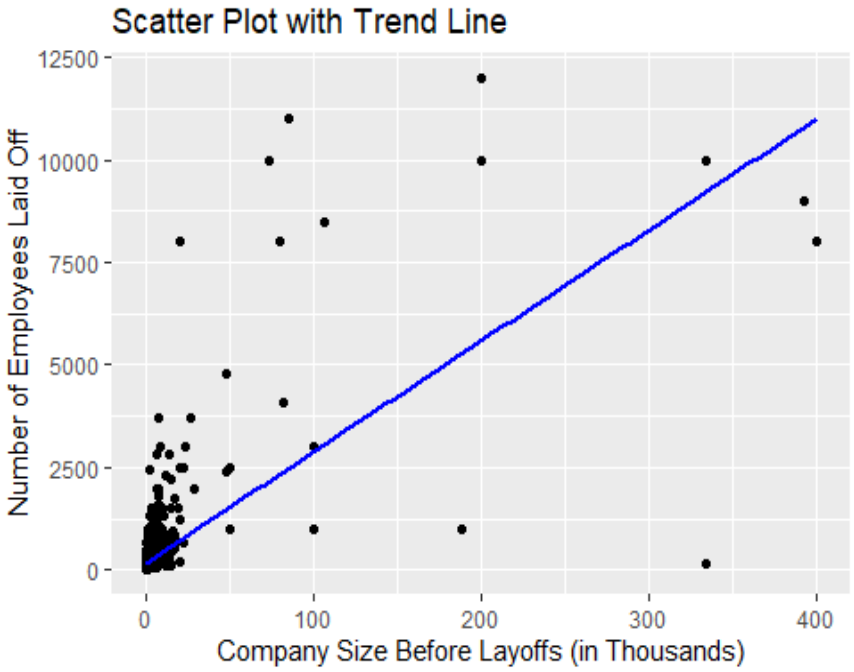
North America stands out with the highest total number of layoffs, followed by Europe and Asia. Africa, Australia, and South America have comparatively lower numbers. This summary offers insights into the regional variations in the impact of layoffs within the tech industry.



The graph represents information on the tech industry layoffs over regions and years. North America shows a substantial increase in layoffs from 2020 to 2023, with a peak in the latter year. Similarly, Asia experiences fluctuations in layoff numbers, while Europe has varying counts each year, including a notable drop in 2021. South America, Australia, and Africa also show distinctive patterns in the layoff data.

On the other hand, based on the dataset, the correlation coefficient between company size before layoffs and the number of employees laid off is 0.6943, indicating a moderately strong positive correlation which suggests that larger companies tend to have higher numbers of layoffs.





According to the scatter plot, it illustrates an upward trend as the company size before layoffs increases, there is a tendency for the number of employees laid off also to increase.

Let's identify the types of data distributions based on Skewness and Kurtosis below:

```
> describe(tech_layoffs$Company_Size_before_Layoffs)
   vars    n    mean       sd median trimmed    mad min   max  range  skew kurtosis     se
X1    1 1418 3556.23 22478.37    531  879.39 594.52   4 4e+05 399996 13.61   206.17 596.93
```

The skewness value of 13.61 indicates a highly positive skewness, and the kurtosis value of 206.17 indicates a more peaked distribution; thus, this distribution is not symmetrical.

Finally, the analysis of tech layoffs from 2020 to 2024 reveals that North America experienced the highest total layoffs and the correlation analysis between company size and layoffs during the timeframe shows a moderately strong positive correlation with the presence of a right-skewed distribution in company sizes further emphasizes the variability in layoffs across different-sized tech companies.

III. Methodology

To further address the research questions, let's calculate confidence intervals for key variables from the dataset by Roger Lee, and perform hypothesis tests to provide robust statistical insights and conclusions.

3.1 Hypothesis Test for Correlation between Company Size and Layoffs

```
data:  tech_layoffs$Company_Size_before_Layoffs and tech_layoffs$Laid_Off
t = 36.302, df = 1416, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.6663213 0.7203179
sample estimates:
      cor
0.6942954
```

Here are the following interpretations:

- P-value: we reject the null hypothesis as the p-value (<0.00000000000000022) indicates there is a statistically significant correlation between the company size and the number of layoffs.
- The sample estimate: there is a moderate positive correlation between company size before layoffs and the number of employees laid off of 0.6942954.
- Confidence Interval: the 95% confidence interval for the correlation is [0.6663213, 0.7203179]. Thus, this interval provides a range of values for the true correlation in the population.

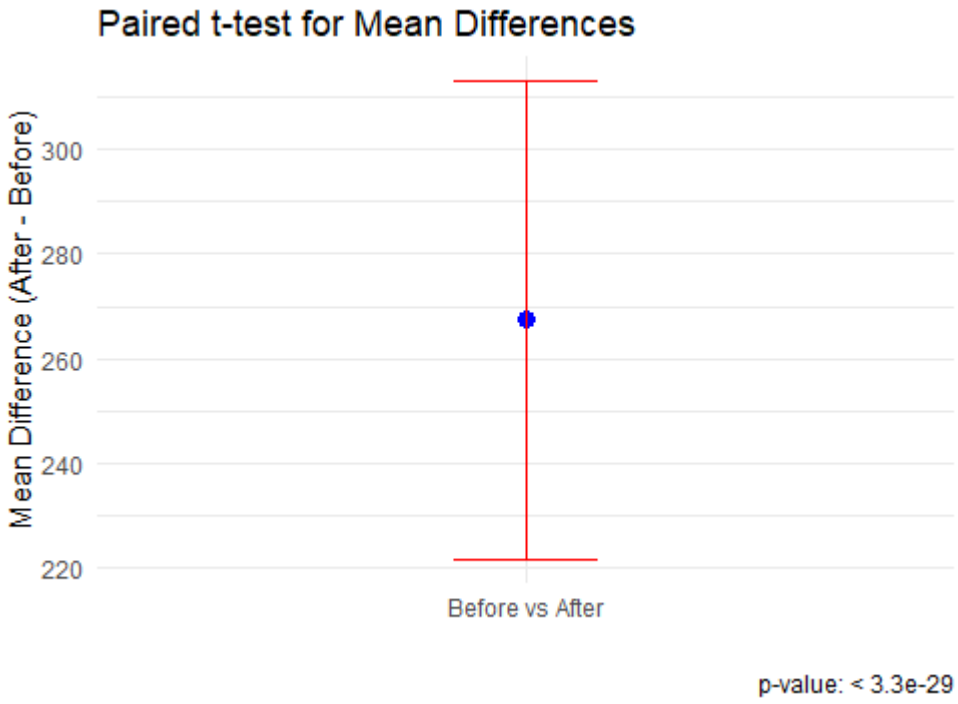
In short, the low p-value and positive sample estimate provided strong evidence to conclude there is a significant positive correlation between company size before layoffs and the number of layoffs from 2020 to 2024.

3.2 T-Test for Differences between Company Size Before and After Layoffs

```
        Paired t-test

data:  tech_layoffs$Company_Size_before_Layoffs and tech_layoffs$Company_Size_after_layoffs
t = 11.475, df = 1417, p-value < 2.2e-16
alternative hypothesis: true mean difference is not equal to 0
95 percent confidence interval:
 221.6820 313.1022
sample estimates:
mean difference
       267.3921
```

The correlation between the company size before and after layoffs is a paired sample test which has produced test statistics (t) of 11.475, the sample estimate of the mean difference is 267.3921 which implies that on average, there is an increase of approximately 267.3921 in the company size after layoffs compared to before layoffs.



Thus, the paired t-test results show a significant and positive mean difference in company size before and after layoffs, with a high level of confidence in the estimated range for the true mean difference.

3.3 Regression Model between the Correlation of Company Size and Laid-Off

Let's interpret the key output of this model. The intercept is 171 representing the estimated value of the dependent variable (Number of Laid Off) when the independent variable (Company Size Before Layoffs) is zero. The coefficient for "Company_Size_before_Layoffs" is 0.0271. This

```
Call:
lm(formula = Laid_Off ~ Company_Size_before_Layoffs, data = tech_layoffs)

Residuals:
    Min      1Q  Median      3Q     Max
-9059.3  -144.0  -109.5   -31.7  8535.7

Coefficients:
                            Estimate Std. Error t value Pr(>|t|)
(Intercept)                1.710e+02  1.698e+01   10.07   <2e-16 ***
Company_Size_before_Layoffs 2.710e-02  7.466e-04   36.30   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 631.7 on 1416 degrees of freedom
Multiple R-squared:  0.482,     Adjusted R-squared:  0.4817
F-statistic:  1318 on 1 and 1416 DF,  p-value: < 2.2e-16
```

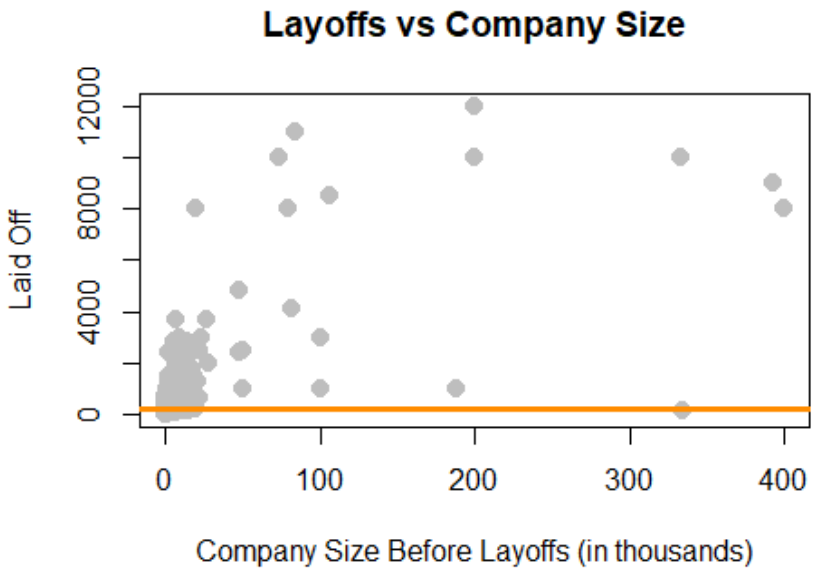
indicates that for a one-unit increase in "Company Size Before Layoffs," the estimated change in the dependent variable is 0.0271 units. Both the intercept and the coefficient for "Company_Size_before_Layoffs" are highly statistically significant (indicated by '***' with p-value < 0.001). This illustrates a strong relationship between company size and the number of layoffs. Residuals represent the differences between the observed values and the values predicted by the model. The spread of residuals is given by the residual standard error, which is approximately 631.7. The Multiple R-squared value of 0.482 indicates that around 48.2% of the variability in the number of layoffs is explained by the model. The F-statistic tests the overall significance of the model. In this case, the F-statistic is 1318 with a very low p-value (< 2.2e-16), suggesting that the model is overall significant.

In short, the regression model shows a statistically positive relationship between the company size before layoffs and the number of employees that have been laid off. The model explains a substantial portion of the variability in the number of layoffs, as indicated by the high R-squared value. The F-statistic further supports the overall significance of the model.

IV. Result and Visualization

Based on the analysis, the patterns of layoffs in the tech industry from 2020 to 2024 differ across continents. North America experienced the highest total number of layoffs during this period, followed by Europe and Asia. This shows that these regions faced more significant challenges in terms of job losses in the tech industry. On the other hand, South America, Australia, and Africa had comparatively lower numbers of layoffs, indicating a relatively less severe impact on their tech industry.

The analysis also explores the correlation between company size and layoffs during this timeframe which reveals a strong positive correlation between the two variables. This means larger companies tend to have higher numbers of layoffs. The scatter plot included in the report demonstrates an upward trend, inducing that as company size before layoffs increases, the number of employees laid off also tends to increase.



Overall, the analysis highlights the regional variations in layoffs across continents and the correlation between company size and layoffs from 2020 to 2024 in the tech industry. These insights provide valuable information for businesses, policymakers, and researchers to understand the dynamics of the tech industry and its impact on the workforce during this period.

V. Conclusion

Based on the result, the findings highlight the regional variations in layoffs, with North America, Europe, and Asia experiencing higher numbers of job losses. This information can be used by policymakers to identify areas where additional support and resources may be needed to mitigate the impact of layoffs and promote job creation in the tech sector.

Additionally, the correlation between company size and layoffs suggests that policies and initiatives targeting larger tech companies may be necessary to address the potential negative effects of automation and economic downturns. This could involve assisting reskilling and upskilling programs, promoting innovation and research and development, and creating incentives for companies to retain and retrain their workforce.

Overall, the analysis provides a comprehensive understanding of the layoff patterns in the tech industry and offers a foundation for future research and policy development. By addressing the challenges and opportunities identified in this study, policymakers, businesses, and researchers can work together to navigate the ever-changing landscape of the tech industry and ensure a resilient and inclusive workforce.

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