Forecasting Workforce Trends in the Tech Sector: A Strategic Approach to Employment Stability

Analyzing Workforce Stability Amidst Automation and Technological Change

November 14, 2024

Jane Zulu

Executive Summary

Enabling Data-Driven Workforce Planning in the Tech Sector

- **OBJECTIVE**
  - Establish a 24-month forecast for tech employment to enable data-driven workforce planning.

- **KEY FINDINGS**
  - Forecast reveals moderate stability in tech workforce demand, with seasonality trends influencing growth.
  - Economic indicators, specifically wages and unemployment rate, emerged as key drivers of employment trends.

- **RECOMMENDATIONS**
  - Adopt SARIMAX for strategic forecasting; focus on proactive hiring and risk mitigation.
  - Prioritize risk management in response to potential volatility in economic indicators.

Background: Navigating Workforce Needs in an Automated and Volatile Market

Understanding employment trends to optimize workforce planning amidst economic and technological changes

The tech sector faces unpredictable shifts in workforce needs due to automation and economic volatility. Accurate forecasts are essential for aligning staffing and budgeting strategies.

Objective: Provide a forward-looking workforce forecast to guide adjustments in hiring and budgeting amidst automation.

Challenge: Navigating volatile economic factors, including wage changes, hiring trends, and unemployment fluctuations.

Focus: Leverage historical data to anticipate workforce trends and inform strategic planning.

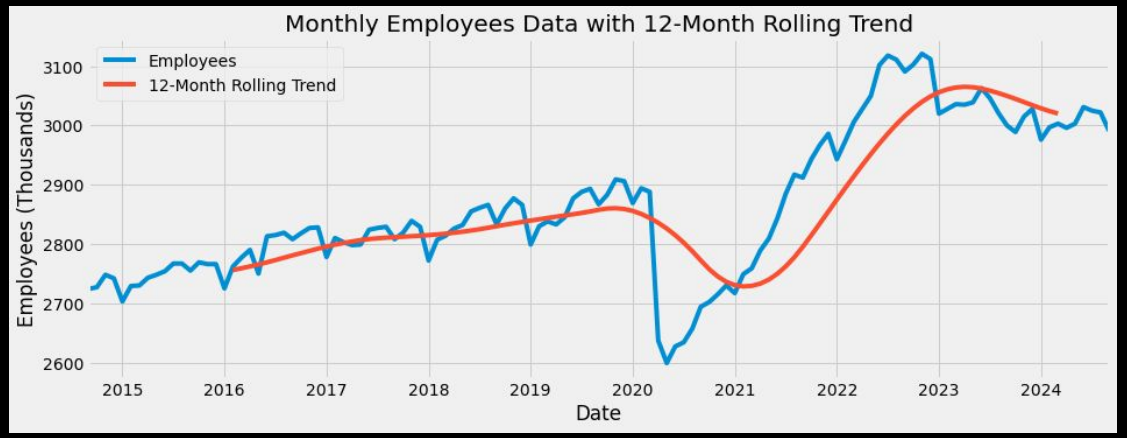


Fig. 1. The 12-month rolling trend highlights volatility and growth patterns in tech employment, emphasizing the need for accurate forecasting.

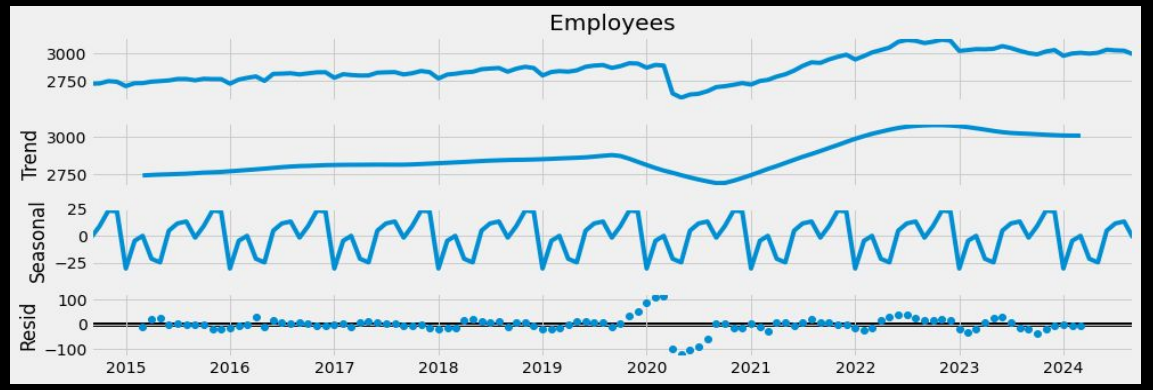


Fig. 2. Decomposition chart highlights seasonal fluctuations and long-term trends

Data Overview: Key Indicators Driving Workforce Forecast

Analyzing Economic Factors to Inform Strategic Workforce Planning

- **DATA SOURCE**

  Source: U.S. Bureau of Labor Statistics

  Frequency: Monthly data from 2014 to 2024 to capture recent, relevant trends in the tech industry.

Variable	Description	Significance
Employees	Total number of employees in the information sector (in thousands)	Essential for assessing sector growth.
Average Hourly Earnings	Average hourly earnings for tech employees (in USD)	Positive impact on employment (↑13.97k per unit increase).
Job Openings	Number of job openings in the tech sector (in thousands)	Small but positive effect (↑0.55k per opening)
Unemployment Rate	Unemployment rate in the tech sector (percentage)	Inversely related (↓37.98k per % increase)

Wages, job openings, and unemployment explain 83% of tech employment variance ($R^2 = 0.83$), highlighting economic drivers in workforce trends.

Fig. 3. Key Economic Indicators in Tech: Employment, hourly wages, job openings, and unemployment rate, highlighting their significance in workforce forecasting.

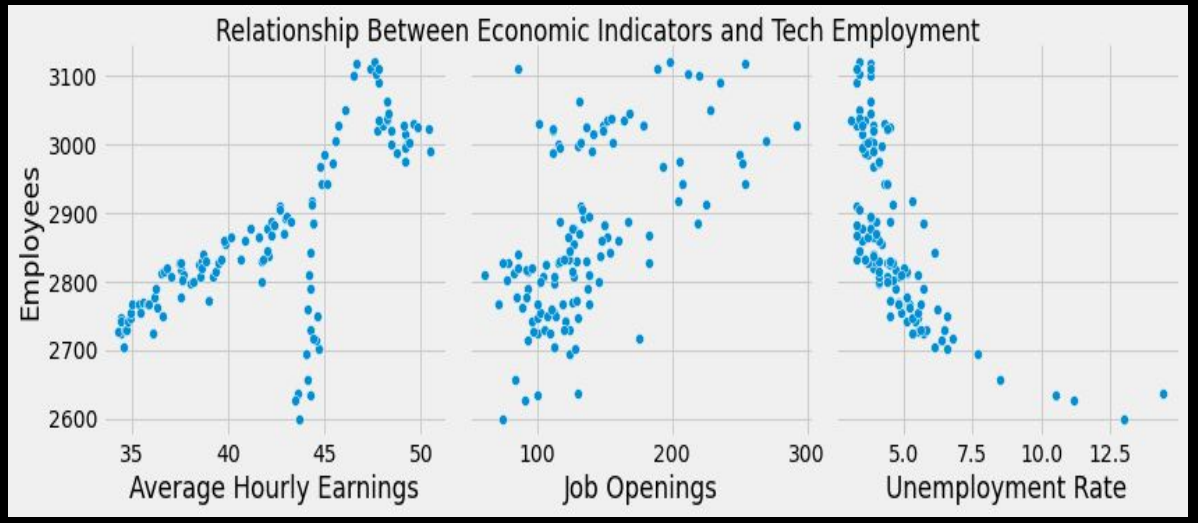


Fig. 4. Pairplot: Correlation of key indicators with tech employment trends from 2014-2024.

Evaluating Forecasting Models

A Comparative Analysis for Optimal Employee Forecasting

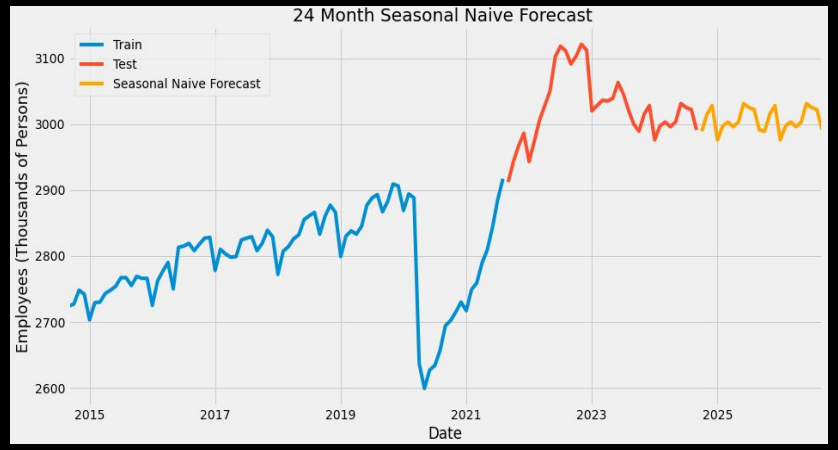


Fig. 5. Seasonal Naive 24 Month Forecast Graph

SEASONAL NAIVE FORECAST

Provides a simple benchmark by repeating last season's values, suitable for stable seasonal patterns but limited in detecting trends or irregular fluctuations.

RMSE : 64.99

MAPE : 0.02

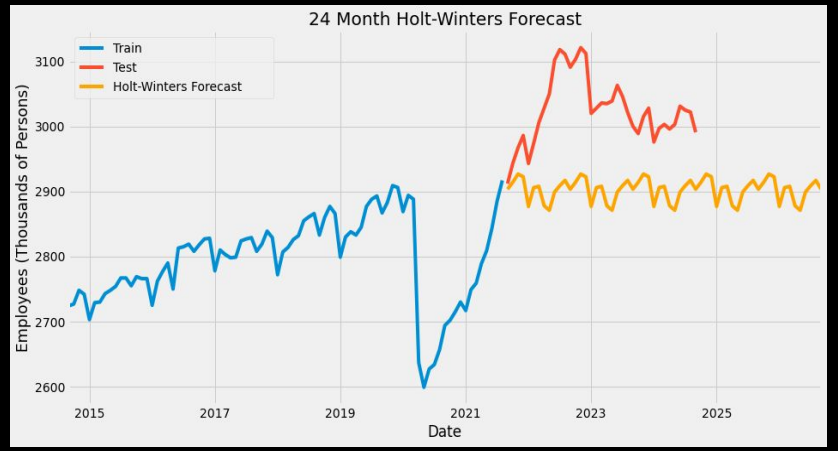


Fig. 6. Holt - Winters 24 Month Forecast Graph

HOLT - WINTERS FORECAST

Incorporates level and trend components, making it better for tracking gradual changes in employment patterns. However, the high RMSE indicates challenges in adapting to abrupt shifts.

RMSE : 132.52

MAPE : 0.04

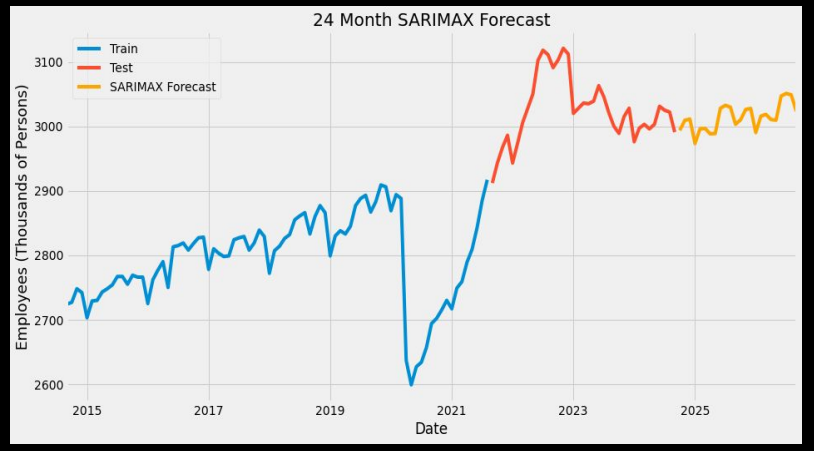


Fig. 7 SARIMAX 24 Month Forecast Graph

SARIMAX FORECAST

Utilizes seasonality and exogenous predictors, providing the most robust fit with lower error metrics. Best suited for complex, evolving employment patterns affected by external economic indicators

RMSE : 45.58

MAPE : 0.01

Model RMSE Comparison: 24-Month Forecast Accuracy

SARIMAX chosen for minimal error metrics and effective seasonality handling

SEASONAL NAIVE FORECAST

Model lacks complexity in capturing trend fluctuations.

HOLTS-WINTERS FORECAST

Model has challenges in adapting to abrupt employment shifts in the tech sector.

SARIMAX FORECAST

SARIMAX **selected** for its **low error and robust seasonal fit.**

Root Mean Squared Error (RMSE) quantifies the average forecast error magnitude. Lower RMSE values reflect higher model accuracy. All models demonstrated low Mean Absolute Percentage Error (MAPE), ensuring reliable forecasts

Projected Stability in Tech Sector Employment

Forecasting stable tech sector employment growth with SARIMAX model insights

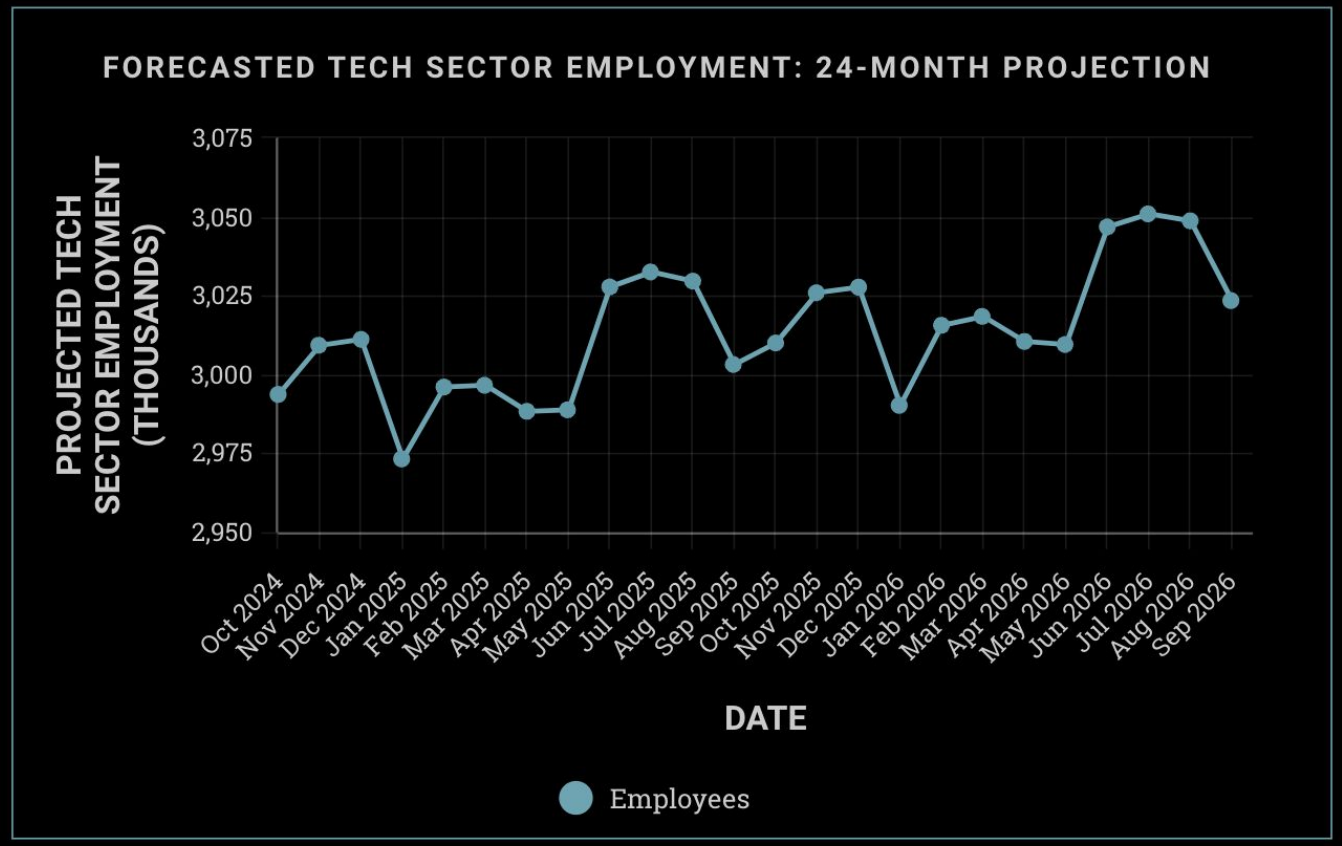
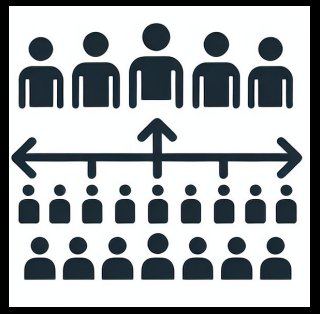


Fig. 8. 24 Month projected employment from SARIMAX Model

Tech sector employment is forecasted to maintain stability, reaching **3.023 million employees by September 2026**—a slight increase from **2.991 million** in September 2024. This outlook highlights resilience in workforce demand amid automation and economic shifts.

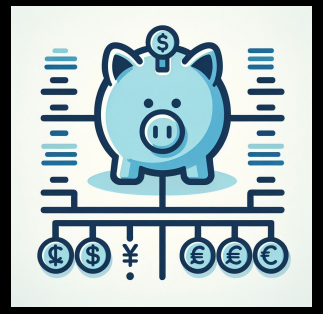
Workforce Strategy for Stability and Growth

Aligning Hiring, Budgeting, and Risk Mitigation with Forecasted Stability



WORKFORCE PLANNING:

Optimize hiring schedules to align with stable demand, focusing on peak seasons.



BUDGET ALLOCATION:

Plan resource allocation around stable demand to maximize cost efficiency

RISK MITIGATION:

Anticipate seasonal fluctuations to align retention and recruitment with demand.