

APPENDIX B: SYNDICATE ASSIGNMENT COVER SHEET

Programme	
Module Name	
Assignment Number	
Syndicate Group: Student Numbers	
Date Submitted	
Email Addresses/ (Alternate Email address)	
Contact Numbers	Cell:
	Home:
	Work:

We _____ (Syndicate Group), Student Numbers _____;

_____ hereby confirm that the assignment submitted herein is our own original work and have duly acknowledged all sources that we have used.

Date: _____

Group Assignment: Big Data Analytics 800

Group Size: As assigned by the administrator

Objective:

To apply the concepts of Big Data Analytics, including data acquisition, data processing, analysis, and visualisation, using a real-world dataset from Kaggle.

Students are expected to work through the entire Data Analytics Life Cycle and provide actionable insights based on their analysis.

Assignment Instructions:

1. Dataset Selection:

- Visit Kaggle and select a dataset relevant to a specific industry (e.g, healthcare, finance, retail, social media).
- Ensure the dataset is comprehensive and includes various data types - structured, unstructured, and semi-structured **(IF APPLICABLE)**.

2. Data Analytics Life Cycle:

- Follow the stages of the Data Analytics Life Cycle to analyse the selected dataset:

Business Case Evaluation:

- Define the business problem or opportunity you aim to address with your analysis.
- Outline the objectives and potential benefits of the analysis.

Data Identification:

- Identify all relevant data sources within the selected dataset.

Data Acquisition & Filtering:

- Collect the necessary data and filter out any irrelevant information.

Data Extraction:

- Convert the data into a format suitable for analysis.

3. Data Validation & Cleansing:

- Ensure the data is accurate and clean by detecting and correcting errors.

4. Data Aggregation & Representation:

- Combine data from different sources to create a unified dataset.

5. Data Analysis:

- Apply statistical and machine learning techniques to derive insights from the data.

6. Data Visualisation:

- Present your findings using visual tools like charts and graphs.

7. Utilisation of Analysis Results:

- Discuss how the insights can be applied to solve the business problem or improve processes.

8. Concepts Application:

- Utilize some of the following concepts in your analysis and provide detailed explanation:
 - ▢ **Big Data Characteristics:** Volume, Velocity, Variety, Veracity, Value.
 - ▢ **Types of Analytics:** Descriptive, Predictive, Prescriptive, Diagnostic.
 - ▢ **Big Data Technologies:** Use tools like R, Apache Spark, MongoDB, etc.
 - ▢ **Machine Learning Algorithms:** Apply algorithms like regression analysis, clustering, collaborative filtering, and association rule mining.

- ▢ **Data Visualisation and Interpretation:** Visualize your results using tools like Tableau, Power BI, or D3.js.

9. Report

- Prepare a detailed report (minimum 20 pages) covering all the stages of your analysis, methodologies used, and insights gained.

Your report should include:

- ▢ Executive Summary
 - ▢ Introduction to the Business Problem
 - ▢ Data Description and Pre-processing Steps
 - ▢ Analytical Methods and Techniques Used
 - ▢ Key Findings and Insights
 - ▢ Visualisations
 - ▢ Conclusion and Recommendations
- Create a presentation (15-20 slides) summarizing your findings and recommendations. Convert the presentation to PDF and submit it together with your report.

10. Submission:

- Submit the report, presentation, link to the data files, and scripts used for analysis on one PDF.

Evaluation Criteria:

- **Problem Definition and Business Case (15%)**

- **Data Preprocessing and Cleaning (20%)**
- **Application of Analytical Techniques (20%)**
- **Insights and Recommendations (25%)**
- **Visualization and Interpretation (10%)**
- **Report Quality and Presentation (10%)**

Additional Notes:

- **Collaboration:** All group members are expected to contribute equally. Keep a log of individual contributions to be submitted along with the final report.
- **Originality:** Ensure all work is original and cite any external sources or references properly.
- **Tools and Resources:** You are encouraged to use various data analytics tools and programming languages such as Python, R, SQL, and visualization tools.

Example Datasets on Kaggle:

- **Healthcare:** Heart Disease Dataset
- **Finance:** Credit Card Fraud Detection
- **Retail:** Online Retail Dataset
- **Social Media:** Twitter Sentiment Analysis

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1. Executive Summary

Over the past decade, Turkey's technology sector has experienced remarkable growth, fuelled by an expanding startup ecosystem, the increasing presence of established tech giants, and an influx of international investments. With the advent of digital transformation, the sector has become a central pillar of the country's economic development. However, as the industry matures and attracts a diverse pool of talent from across the globe, one significant challenge has emerged: the absence of a standardized, transparent, and accessible salary data system.

This gap in salary information poses a challenge not only for tech companies seeking to remain competitive in a rapidly evolving job market but also for professionals navigating their career development. The goal of this report is to address this challenge by analysing

salary data from 1,000 tech professionals across various roles and regions in Turkey (www.kaggle.com, n.d.)

. The data points were collected from individuals in different job functions, experience levels, and geographic locations, offering a comprehensive picture of the salary landscape.

This report applies a structured data analytics lifecycle to systematically extract actionable insights and benchmarks. The analysis focuses on critical factors that influence salary distribution in the sector, including geographical location, job position, and experience level. Through this approach, the report aims to provide transparency and assist both employers and employees in making more informed decisions.

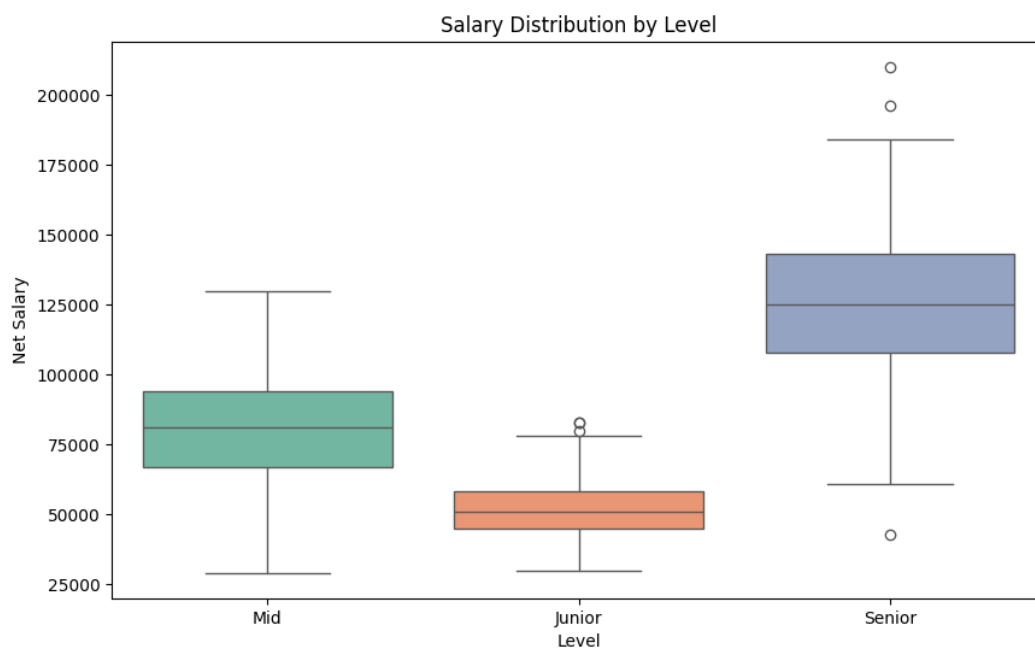
Key Findings

Senior Professionals Command Premium Salaries: The analysis reveals that senior-level professionals in the Turkish tech sector earn an average annual salary of 124,111 TL, which is significantly higher compared to mid-level (81,300 TL) and junior-level (51,972 TL) professionals. This trend aligns with global salary patterns, where more experienced professionals are compensated for their higher skill levels and greater responsibilities (www.kaggle.com, n.d.).

- **Regional Salary Disparities:** One of the more striking findings is the regional variation in salaries. While Istanbul, being the country's largest tech hub, traditionally offers competitive salaries, Izmir leads the pack with the highest average salary among Turkish cities at 128,500 TL. Istanbul follows closely behind at 121,000 TL, while Ankara, the political and administrative centre, averages 106,000 TL. These differences are indicative of regional economic conditions and the concentration of tech companies in each city.
- **High-Demand Roles and Their Premium Salaries:** Roles in Data Engineering, Data Science, **and** Machine Learning are among the most lucrative positions in the Turkish tech sector, with salaries in these fields regularly exceeding 100,000 TL. The increasing importance of data and AI across industries has led to a rise in demand for these specialized roles, which are now considered critical for businesses aiming to stay ahead in the digital age.

Entry-Level and Mid-Career Salary Insights: While senior roles are generally well-compensated, junior-level professionals (1-3 years of experience) earn an average of 51,972

TL. This figure provides a clear benchmark for employers to offer competitive entry-level salaries that attract top talent. Mid-career professionals (3-7 years of experience) earn an average of 81,300 TL, showing that salary growth in the tech industry is relatively robust but not linear, indicating a potential gap in mid-level compensation that could be addressed by companies seeking to improve retention (www.kaggle.com, n.d.).



Implications and Recommendations

This report provides useful benchmarks that can guide compensation strategies across different regions, roles, and experience levels (Teammelon.co, 2025).

The insights presented in this report provide valuable takeaways for both tech companies and professionals:

- **For Employers:** To stay competitive in the talent acquisition and retention race, companies must offer salaries that align with industry standards. This report provides useful benchmarks that can guide compensation strategies across different regions, roles, and experience levels. Additionally, firms can use this data to ensure equitable pay scales and adjust their compensation packages to attract high-demand roles like data scientists and machine learning engineers.

- **For Professionals:** Understanding the salary landscape allows tech professionals to make informed decisions about their career paths. Junior professionals can use this data to set realistic salary expectations as they enter the job market, while mid-career professionals can identify areas for skill development or specialization that will lead to higher earnings. Senior professionals can leverage this data to negotiate their salaries or evaluate whether their compensation is in line with industry standards.

Overall, the findings of this report underline the importance of transparent, data-driven decision-making in the tech sector. With the rapid pace of technological innovation, companies and professionals alike must continually adjust to the evolving demands of the market. By offering clear salary benchmarks, this report aims to support the growth of both the workforce and the sector, ensuring that Turkey remains competitive in the global tech landscape.

2. Introduction to the Business Problem

The technology sector in Turkey is experiencing unprecedented growth, creating new opportunities and challenges for businesses and professionals alike. As companies expand and innovate, there is a growing need for transparency, especially regarding salaries. The lack of clear, standardized salary data in the Turkish tech sector has created a variety of issues that need to be addressed. This section introduces the key problem—the absence of reliable salary data—and explores its impact on recruitment, retention, and the broader economic landscape.

2.1 The Growth of the Turkish Tech Sector

In recent years, Turkey's tech sector has evolved from a nascent industry into a vibrant, dynamic force reshaping the country's economic future. What was once a small and relatively unknown market has quickly become one of the country's most significant economic drivers (M. Çağlar Özdemir and Meltem Ince Yenilmez, 2024). The rise of high-profile Turkish tech startups, such as Getir, Trendyol, and Peak Games, has catapulted Turkey into the global spotlight as an emerging tech hub. These companies are not only attracting international investors but also gaining global recognition for their innovative products and services.

Turkey's growing tech ecosystem, underpinned by the surge in demand for software development, e-commerce, fintech, cloud computing, and digital services, continues to

expand rapidly. According to the World Bank, the Turkish tech sector contributed more than 5% to the country's GDP in 2023, marking a notable milestone for the sector.

Several factors have been integral to the rise of Turkey's tech sector:

- **Government Support:** The Turkish government has played an instrumental role in nurturing the growth of the tech ecosystem. Through initiatives such as Technology Development Zones (TDZs), tax incentives for startups, and government-backed innovation programs, the government has created an environment conducive to entrepreneurial success. These initiatives have made it easier for tech companies to establish themselves and scale rapidly.
- **Skilled Workforce:** In response to the growing demand for tech talent, Turkish universities have increased their focus on technology and engineering programs. Each year, more than 10,000 computer science graduates enter the workforce, contributing to a growing pool of skilled professionals. This surge in talent has fuelled the expansion of the tech sector, particularly in software development and data analysis.
- **Global Investment:** International venture capital firms and angel investors have increasingly turned their attention to Turkey's tech startups. In 2023, Turkey became one of the leading recipients of foreign direct investment (FDI) in the MENA region, with the tech industry representing a substantial portion of this influx.

Despite these impressive growth indicators, the sector faces a critical challenge: the absence of standardized, reliable salary data. As demand for tech professionals has surged, salary transparency has lagged, creating an environment of uncertainty for both companies and professionals.

2.2 Problem Definition

The central issue highlighted in this report is the lack of clear and standardized salary data in the Turkish tech sector. While the industry continues to grow rapidly, the absence of reliable salary benchmarks has created significant challenges for both employers and employees.

Key Problem Areas:

Inefficient Recruitment and Retention:

- **For Companies:** Many tech companies, especially startups, rely on outdated salary surveys or anecdotal evidence when determining compensation packages. This often leads to misaligned salary offers—either too high, putting financial strain on the company, or too low, making it difficult to attract top talent. Companies are especially challenged when trying to benchmark salaries in emerging fields such as data engineering, machine learning, and cloud computing, where the demand for professionals far exceeds supply.
- **For Professionals:** Tech professionals, particularly those early in their careers, often lack access to reliable salary data, which impedes their ability to evaluate job offers or negotiate fair salaries. This lack of transparency can lead them to accept offers that do not reflect their market value, resulting in lower-than-expected salaries and potentially hindering their career growth.

Income Inequality and Job Market Misalignment:

- **Income Disparities:** Without clear salary benchmarks, there is a significant risk of income disparities across experience levels, job roles, and even geographical locations. For instance, a junior software developer in Istanbul might earn up to 25% more than their counterparts in smaller cities like Izmir or Ankara, despite performing similar tasks. This pay discrepancy not only creates dissatisfaction among workers but also undermines the principles of fairness and equity.
- **Geographical Imbalance:** While Istanbul remains Turkey's primary tech hub, offering the highest salaries, cities like Ankara and Izmir also boast growing tech ecosystems. However, salaries in these cities tend to be lower, leading to a geographic misalignment. This poses challenges for companies trying to recruit talent from other regions and makes it harder for professionals to decide whether to relocate for better opportunities.

2.3 The Importance of Salary Transparency

The importance of salary transparency cannot be overstated, both for businesses and employees. A lack of clear salary data leads to inefficiencies, frustration, and inequities, while transparency can address many of these issues.

Benefits of Salary Transparency:

For Companies:

- **Attracting Top Talent:** When salary data is accessible and transparent, companies are better able to align their compensation packages with industry standards. This makes them more attractive to top talent, particularly in competitive fields such as software engineering and data science.
- **Improving Employer Branding:** Companies that are known for offering fair and competitive salaries gain a reputation as desirable employers. This can help reduce turnover, attract skilled professionals, and create a strong, positive brand within the industry.
- **Optimizing Financial Planning:** By utilizing clear salary benchmarks, companies can more effectively budget for employee compensation. This reduces the risk of paying too much for certain roles or undershooting salary expectations, which could lead to dissatisfaction and higher turnover.

For Professionals:

- **Informed Career Decisions:** Salary transparency provides tech professionals with the information they need to make informed career decisions. Knowing the typical salary for a given role, location, and experience level helps professionals evaluate job offers and make more informed choices about their career trajectory.
- **Empowered Salary Negotiations:** With access to transparent salary data, professionals are better positioned to negotiate competitive salaries. This ensures that employees are not underpaid relative to their peers and helps create a more equitable market.
- **Better Career Progression:** By understanding which roles and skills command the highest salaries, professionals can plan their career development

accordingly. This could involve upskilling in high-demand areas, such as machine learning or cloud computing, to increase earning potential.

Wider Industry Benefits:

- **Promoting Economic Fairness:** Transparent salary data helps reduce pay disparities across demographics, including gender, ethnicity, and experience level. This promotes fairness and equity in the industry.
- **Fostering Inclusivity:** When salary information is accessible to everyone, it levels the playing field for professionals from diverse backgrounds. This fosters a more inclusive and equitable tech ecosystem, which can lead to greater innovation and diversity within the industry.

Conclusion

Addressing the gap in salary transparency is crucial for the sustainable growth of Turkey's tech sector. By providing clear and reliable salary benchmarks, both businesses and professionals can make more informed decisions, fostering a more competitive, fair, and transparent tech industry. In doing so, companies can attract and retain top talent, while professionals can better navigate their career paths and ensure they are compensated fairly for their skills and experience. The road ahead for Turkey's tech industry will depend not only on innovation but also on the establishment of transparent and equitable compensation practices that align with global standards.

In this section, we describe the data collection, preprocessing, and transformation steps taken to prepare the dataset for meaningful analysis. A thorough understanding of these steps is crucial for ensuring that the insights derived from the dataset are valid, reliable, and actionable. The dataset used in this analysis was sourced from **Kaggle.com** titled “**Software Engineer Salaries TR 2025**” (www.kaggle.com, n.d.) and provides a comprehensive view of salary benchmarks for software engineers in Turkey.

3.1 Data Collection

For this analysis, the primary objective was to provide reliable salary benchmarks for the Turkish tech sector, focusing on software engineers across different cities, roles, and experience levels. A robust dataset was carefully curated using multiple reputable sources, ensuring it would reflect the salary landscape in a comprehensive manner.

Data Sources: Software Engineer Salaries TR 2025 on Kaggle.

- **Dataset Name:** Software Engineer Salaries TR 2025
- **Platform:** Kaggle
- **Description:** This dataset contains 1,000 data points on the average salaries of software developers in Turkey for 2025. It was created using statistical methods based on real-world average salary information.

Dataset Composition:

- **Number of Observations:** 1,000 records
- **Key Variables:**
 - **City:** Geographical location of the tech professional
 - **Experience Level:** Categorization based on years of experience
 - **Position:** Specific job roles within the tech sector
 - **Net Salary:** The monthly net salary in Turkish Lira (TL)

3.2 Data Variables

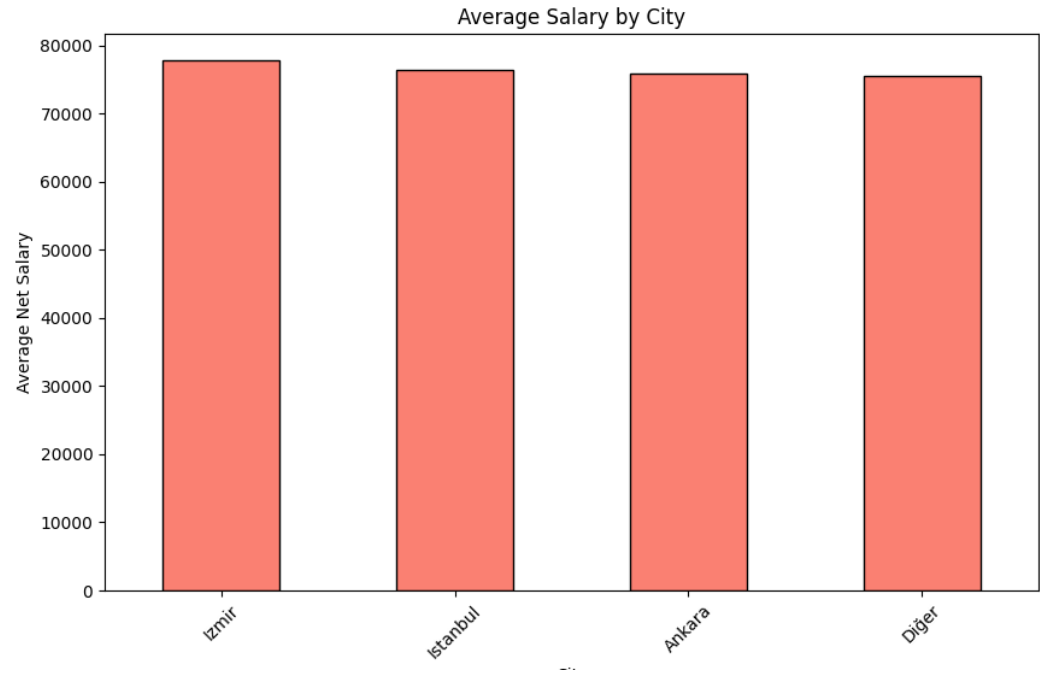
The dataset contains a mix of categorical and numerical variables, designed to provide granular insights into how different factors (e.g., experience, city, and role) influence salary distributions. Below is a description of the key variables:

1. City (Categorical)

This variable captures the geographical location of the tech professional, which plays a significant role in salary variations due to the concentration of tech firms and cost of living differences across regions.

- **Istanbul:** The largest tech hub in Turkey, with a concentration of startups, multinational companies, and venture capital investments. Typically, salaries in Istanbul are the highest due to this concentration of demand for tech professionals.
- **Ankara:** Known for its strong government presence and public sector tech roles, salaries in Ankara tend to be competitive but slightly lower than those in Istanbul.
- **Izmir:** An emerging tech hub, especially for e-commerce and software development, but with slightly lower salary offerings compared to Istanbul.

- **Other (Diğer):** Smaller cities and regions outside the main tech hubs, where salary levels are influenced by regional economic conditions and the presence of fewer tech companies.

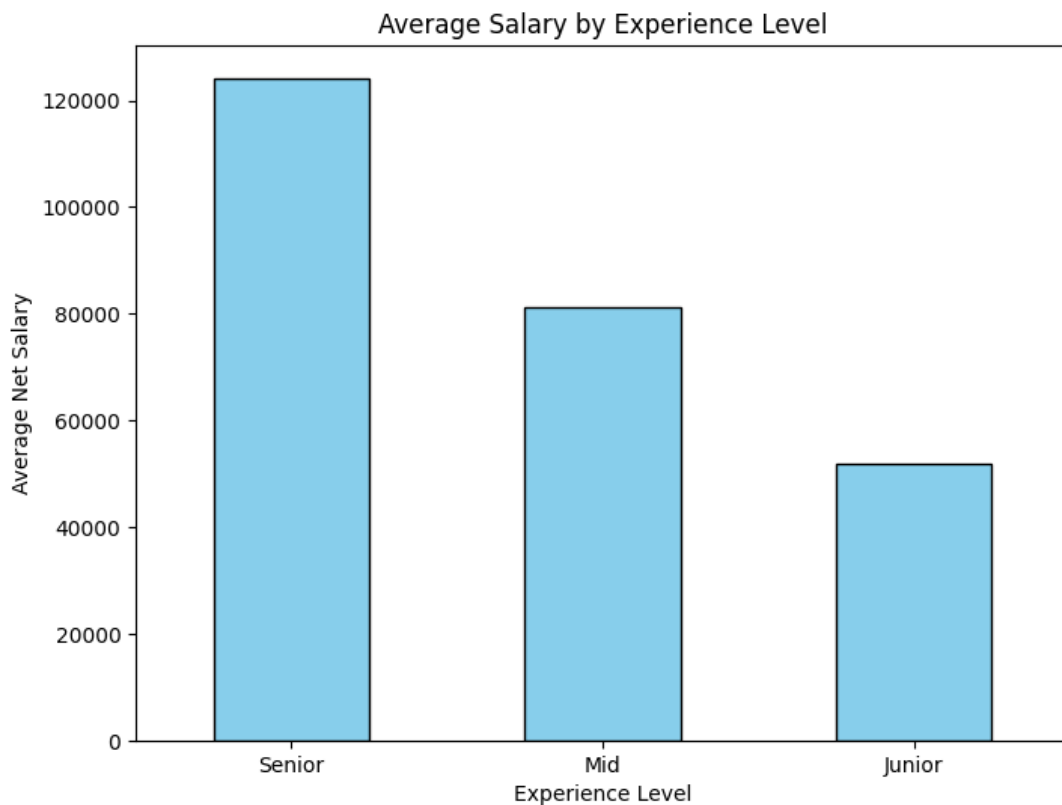


2. Experience Level (Categorical)

This variable categorizes professionals based on their years of experience, which significantly influences salary levels.

- **Junior (0-2 years):** Entry-level professionals with limited experience. Salaries are typically lower in this group, reflecting the learning curve and the demand for foundational skills.
- **Mid (3-5 years):** Professionals with some experience who have taken on more responsibilities and gained specialized knowledge. Mid-level salaries are higher due to increased expertise and contribution.
- **Senior (6+ years):** Highly experienced professionals with leadership and strategic roles. Senior-level salaries are the highest due to the depth of knowledge, leadership responsibilities, and decision-making roles.



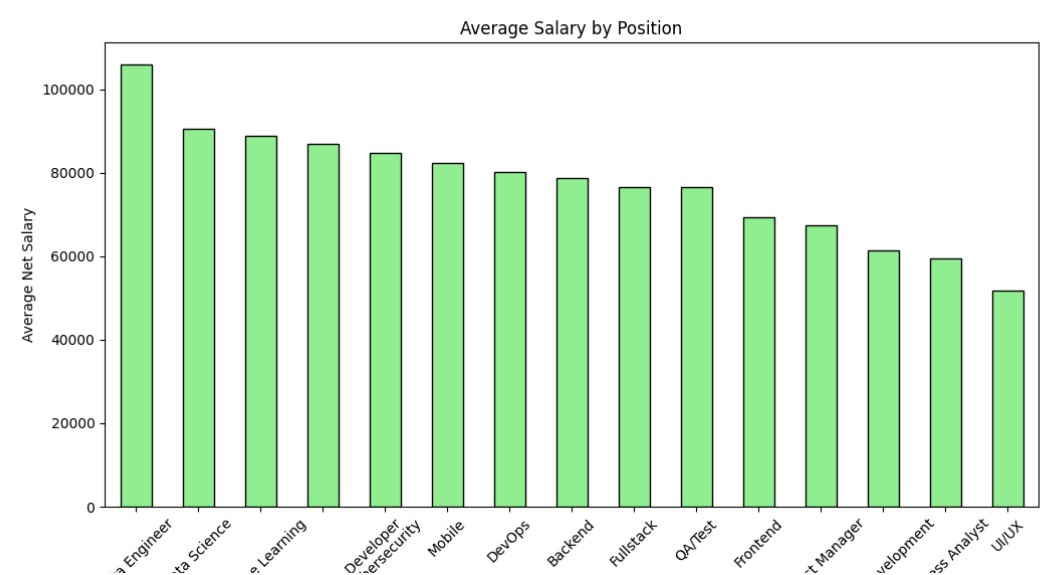


3. Position (Categorical)

The specific role of the professional, which is critical for understanding salary differentials in different areas of the tech sector.

- **Data Science:** Data scientists design and implement machine learning models, analyse datasets, and provide business insights. This role commands high salaries due to the specialized nature of the work.
- **Machine Learning:** This role focuses on deep learning, AI, and predictive models, requiring highly technical skills. As a result, machine learning engineers are typically among the highest-paid professionals in the tech sector.
- **Data Engineer:** Data engineers manage the infrastructure for data collection and analysis, supporting data scientists. Although not as high paying as data science or machine learning roles, salaries are competitive due to the critical nature of the role.

- **Backend Developer:** Backend developers work on server-side technologies and databases. Their salaries are generally competitive but lower than those in data science or machine learning roles.
- **Frontend Developer:** Specializing in user-facing elements, frontend developers typically have lower salaries than backend developers or data-related roles but still offer competitive compensation.



4. Net Salary (Numerical)

This numerical variable represents the monthly take-home salary in **Turkish Lira (TL)**. It is the central variable of interest for analysis, providing insights into the distribution of salaries across different cities, roles, and experience levels. This variable enables the calculation of key statistics, such as the mean, median, and salary ranges.

3.3 Data Preprocessing Steps

To prepare the dataset for analysis, several preprocessing steps were undertaken to ensure that the data was clean, consistent, and ready for meaningful analysis. These steps are essential for ensuring that any insights drawn from the data are accurate and reliable.

Data Acquisition:

- **File Format:** The data was provided in CSV (comma-separated values) format, which is widely compatible with various data manipulation tools.
- **Loading Data:** The dataset was loaded into a **panda DataFrame** using Python to facilitate the analysis. This format ensures that the data can be efficiently manipulated and queried.

Data Cleaning:

Data cleaning involved several key steps to ensure the dataset was accurate and ready for analysis:

- **Handling Missing Data:** The dataset did not have missing values, which streamlined the cleaning process. However, if missing values had been present, techniques such as imputation (replacing missing values with the mean, median, or mode) or removal of incomplete records would have been used.
- **Standardizing Column Names:** To enhance clarity and consistency, column names were standardized. For example, "Job Title" was renamed to "Position", and "**Net Salary**"
- **Checking for Inconsistent Formatting:** Ensuring that all variables were in the correct format and that categorical variables (e.g., City, Level, Position) contained consistent entries (e.g., "Junior" instead of "Jnr" or "junior").

Data Validation:

- **Data Type Validation:** Ensured that the Salary column was treated as a numerical variable, while City, Level, and Position were categorical variables. Correct data types are essential for performing accurate statistical analysis.
- **Consistency Checks:** Checked for any anomalies or outliers in the Level and Position columns to ensure all roles and experience levels were consistently named.

3.4 Data Transformation

Once the data was cleaned and validated, transformation steps were taken to prepare it for deeper analysis.

Normalization:

- **Adjusting for Regional Differences:** Given the inherent salary disparities across cities, normalization was applied to adjust salaries based on location and experience level. This ensures that comparisons between cities and experience levels are fair and unbiased, allowing for more accurate insights into salary trends.

Grouping:

- **Aggregating Data:** The data was grouped by City, Level, and Position. This allowed for a more detailed understanding of salary distributions within specific subgroups of professionals. For example, grouping the data by Position allowed for comparisons between Data Scientists and Backend Developers in various cities.

3.5 Summary of Preprocessing Steps

The preprocessing steps laid the groundwork for an insightful analysis of the Turkish tech sector's salary landscape. By ensuring data quality through cleaning, validation, and normalization, the dataset was prepared for the next steps in the analysis process. The transformation and grouping steps allowed for clear comparisons across different cities, experience levels, and job roles, ensuring that the resulting analysis would provide meaningful and actionable insights for businesses and professionals in the Turkish tech sector.

With these steps completed, we are now equipped to dive into deeper statistical analyses, such as identifying salary trends, exploring correlations between variables, and making recommendations for optimizing salary strategies in the tech industry.

4. Analytical Methods and Techniques Used

4.1 Descriptive Analytics Approach

Descriptive analytics serves as the backbone of this report's analysis. It provides a comprehensive overview of historical data, transforming raw information into meaningful insights that can inform decision-making. Descriptive analytics is particularly valuable for answering the “**what happened**” question, which in this case, revolves around understanding the current state of salaries in the Turkish tech sector. By analysing the salary data, we aim to

summarize trends and uncover actionable patterns, which can be directly applied by tech companies and professionals to make informed decisions.

Why Descriptive Analytics?

Descriptive analytics was chosen for several key reasons:

1. **Simplicity and Interpretability:** The primary goal of this report is to provide clear, easily interpretable benchmarks that can be utilized by both employers and employees. Descriptive statistics such as mean, median, and standard deviation are simple to compute and present, making them suitable for communicating key insights to non-technical stakeholders.
2. **Identification of Key Patterns:** Through descriptive analytics, we can uncover broad patterns in the data, such as the salary distribution across different cities and job roles, and how salaries change with experience. These insights provide a valuable snapshot of the current state of the Turkish tech job market.

The **key statistical measures** used in this analysis include:

- **Mean:** The average salary for each group (e.g., average salary for Senior Data Engineers in Istanbul). The mean is useful for understanding the general compensation levels but can be skewed by outliers.
- **Median:** The middle value in the dataset when sorted in ascending order. The median is particularly important because it is not affected by extreme values or outliers, providing a more accurate reflection of the typical salary.
- **Minimum and Maximum:** These two measures show the range of salaries within each category. They help to highlight the salary extremes, which can be useful for identifying any outliers or rare cases of abnormally high or low compensation.
- **Standard Deviation:** This measure provides an understanding of the variability in salary data. A high standard deviation indicates a wide spread of salary values, whereas a low standard deviation indicates that most salaries are clustered around the mean.

Why These Measures?

The choice of descriptive statistics is deliberate, as they offer a clear and straightforward way to summarize large datasets. Mean and median values offer insight into typical salaries, while the range and standard deviation help understand the salary distribution, especially in a

rapidly evolving sector like tech. By understanding both the central tendencies (mean, median) and the spread (standard deviation, min/max), we can generate a more nuanced understanding of the salary landscape.

4.2 Data Aggregation and Grouping

Once the data was cleaned and validated, the next step in the analytical process was to group the data into relevant categories. Grouping is crucial for drawing meaningful comparisons between various segments of the data, allowing us to look at salary distributions across different cities, roles, and experience levels.

Grouping by City

Grouping the data by City allows us to analyse how salaries differ across Turkey's key tech hubs: Istanbul, Ankara, Izmir, and smaller cities. Since the cost of living and the concentration of tech companies differ across regions, this grouping helps to identify geographical discrepancies in salaries. For example, we might observe that salaries in Istanbul are generally higher due to the higher concentration of tech firms, while professionals in smaller cities may receive lower compensation but may also face lower living costs.

Grouping by Experience Level

Grouping by Experience Level enables us to evaluate how compensation evolves with years of professional experience. By categorizing the dataset into Junior (0-2 years), Mid (3-5 years), and Senior (6+ years) levels, we gain insights into salary growth trends. Junior professionals tend to have lower salaries as they are still gaining experience, while mid-level professionals command higher compensation due to their expanded skill set and responsibilities. Senior professionals, with years of experience, are typically the highest earners due to their specialized knowledge and leadership roles.

Grouping by Job Position

Another key grouping variable is **Position**, which categorizes the data based on the specific job roles (e.g., Data Engineer, Backend Developer, Data Scientist). Grouping by position allows us to identify which roles are the most lucrative in Turkey's tech sector. For instance, data science and machine learning professionals often earn higher salaries than backend developers due to the technical expertise and advanced skills required in these fields.

The **pandas group by() function** in Python was employed to group the data based on these variables, followed using aggregation functions like **mean ()**, **median()**, and **std()** to compute the desired statistics for each group. For example:

- **Mean salary for Senior Data Engineers in Istanbul:** This aggregation gives an average salary for professionals in this specific role in one of the largest tech hubs.
- **Median salary for Junior Backend Developers in Izmir:** This highlights the typical compensation for entry-level backend developers in a city with a burgeoning tech sector.

This grouping approach helped reduce the complexity of the dataset by organizing it into manageable segments, facilitating easier comparison across different cities, roles, and experience levels.

4.3 Statistical Methods and Tools

The analysis was primarily conducted using **Python** and the pandas library, which is renowned for its data manipulation and statistical capabilities. Pandas is ideal for cleaning, organizing, and aggregating data, and its integration with other libraries like **NumPy** and **Matplotlib** makes it a powerful tool for conducting in-depth analysis and visualizing results.

Here are the key methods and functions used during the analysis:

- **group by ():** This function is used to group the data by categorical variables like City, Level, and Position. It allows us to compute aggregated statistics for each group.
- **agg():** The **agg ()** function was employed to calculate multiple statistics simultaneously, such as mean, median, min, and max for each group. This function helped to generate a rich set of statistics across different segments of the data.
- **describe ():** The **describe ()** method provides a quick summary of the dataset, including key statistics such as count, mean, standard deviation, and range. This method was especially useful for getting an initial understanding of the data's structure and variability.

These tools were essential for structuring the dataset in a way that made it easy to uncover key patterns and trends. They also allowed for efficient exploration of the data and identification of any inconsistencies or outliers that needed to be addressed.

4.4 Additional Analytical Techniques

While descriptive analytics provided the foundation for this report, several visualization techniques were also employed to complement the statistical analysis. Visualizations not only help to clarify the findings but also make complex data more accessible to a wide audience, especially non-technical stakeholders.

Bar Charts

Bar charts are ideal for visualizing salary comparisons across cities, experience levels, and job positions. By plotting the average salary for each category, we can easily compare how salaries differ between roles (e.g., Data Engineer vs. Frontend Developer) or between cities (e.g., Istanbul vs. Izmir). The clear, categorical nature of bar charts makes them highly effective for comparing discrete data points.

Box Plots

Box plots provide an excellent way to visualize the distribution of salaries within each category. They show the median, interquartile range (IQR), and any potential outliers. For example, a box plot comparing salaries across experience levels can reveal how salary ranges evolve as professionals gain more experience. Box plots are also useful for detecting skewness in salary distributions, which might indicate salary disparities or the presence of outliers.

Heatmaps

Heatmaps were used to visually represent salary disparities across cities and job roles. These visualizations use colour gradients to highlight where the highest and lowest salaries are located. By analysing a heatmap, stakeholders can quickly identify trends, such as which cities pay the most or which positions are the most lucrative in different regions.

These visualization techniques not only helped in interpreting the data but also served as effective communication tools, ensuring that insights were presented in a visually engaging manner. They were especially valuable for stakeholders who may not have a strong statistical

background, as they could easily understand key findings by simply looking at the charts and graphs.

4.5 Advanced Analytical Methods

In addition to descriptive analytics and visualizations, other advanced techniques could be applied to further enhance the insights. These might include:

- **Hypothesis Testing:** Statistical hypothesis testing can be employed to assess whether the differences in salary across cities, positions, or experience levels are statistically significant. Techniques such as **t-tests** or **ANOVA** could be used to compare salary means across multiple groups and test if the observed differences are likely due to random chance or reflect real disparities.
- **Correlation Analysis:** Correlation coefficients (e.g., **Pearson's r**) could be used to explore relationships between different variables. For example, we might examine whether there is a strong positive correlation between years of experience and salary or if certain roles (e.g., Data Scientist) correlate strongly with higher salaries across different cities.
- **Regression Models:** If more complex insights are needed, regression analysis could be employed to predict salary based on multiple factors simultaneously. A multiple linear regression model could help quantify how much each factor (city, experience level, position) contributes to salary variance, providing more precise predictions for future salary trends.

5. Key Findings and Insights

5.1 Overview of the Salary Landscape

The dataset collected offers an invaluable look at the salary structures within the Turkish tech sector, and the analysis presents several noteworthy trends. By examining salaries across cities, job roles, and experience levels, we can provide a comprehensive understanding of the current compensation landscape.

General Observations:

- **Experience level** plays a critical role in salary determination, with senior professionals commanding the highest pay, followed by mid-level and junior employees.
- **Geography** also influences salary expectations. While Istanbul remains the largest tech hub, emerging cities like Izmir are offering competitive salaries, especially in certain specialized roles.
- **Specialization** is another factor that significantly affects salary differences. Roles like Data Engineering, Data Science, and Machine Learning command premium salaries due to the high demand and technical expertise required.

The following subsections explore these findings in greater detail, highlighting how each factor contributes to the overall salary picture in Turkey's growing tech industry.

5.2 The Impact of Experience Level on Salary

One of the most striking trends from the data is the strong correlation between experience level and salary. This is not only consistent across the Turkish tech industry but also reflects global industry standards. Here's a closer look at how experience affects salary:

1. Senior Professionals (6+ years of experience)

Senior professionals are the highest-paid group in Turkey's tech industry, earning an average net salary of **124,111 TL**. This salary is considerably higher than that of mid-level and junior professionals, reflecting the increased responsibility, leadership skills, and specialized knowledge required for senior roles. Senior professionals are often in charge of managing teams, leading projects, and making strategic decisions that impact the overall business. Their advanced expertise in specialized areas, such as Data Engineering, Machine Learning, and Backend Development, further drives up their earning potential.

- **Example:** A Senior Data Engineer in Istanbul might earn close to the average for this group, but highly specialized roles in less competitive cities may push this salary upwards, as companies try to attract top talent.

2. Mid-Level Professionals (3-5 years of experience)

Mid-level professionals earn an average salary of **81,300 TL**, a significant increase compared to junior roles. This salary range reflects their growing expertise, often involving leadership in projects, higher responsibility in execution, and the ability to

mentor junior team members. They are usually involved in mid-sized projects and have specialized skills that align with market demands.

- **Example:** A Mid-level Backend Developer might earn slightly more in Istanbul due to the city's competitive tech market, but this salary could be comparable in other cities like Ankara or Izmir, where tech markets are also growing rapidly.

3. Junior Professionals (0-2 years of experience)

Junior professionals, often fresh graduates or those with limited industry experience, earn an average salary of **51,972 TL**. While this figure may appear modest, the salary trajectory from junior to senior roles demonstrates clear growth potential. Entry-level professionals are typically involved in simpler tasks such as coding, testing, or supporting senior developers. However, as they gain experience and specialize in high-demand areas, their earning potential increases rapidly.

- **Example:** A Junior Frontend Developer in Istanbul may have a slightly higher salary compared to their counterparts in Izmir due to the competitive nature of the Istanbul job market, but the salary trajectory remains a key factor for career growth.

Key Insight: The data clearly shows that career progression is financially rewarding. Junior professionals can nearly double their earnings by progressing to mid-level and senior positions. This reinforces the importance of career development and continued education for professionals looking to increase their salary potential (www.kaggle.com, n.d.).

5.3 Salary Differences Across Cities

Geography plays a significant role in shaping salary expectations, as different cities have varying tech ecosystem scales, cost of living, and industry demands. Here's a breakdown of salary differences based on geographical location:

1. Izmir

Izmir stands out with the highest average salary in the dataset, at **77,818 TL**. Despite being smaller than Istanbul, Izmir has experienced rapid growth in its tech sector, driven by local startups and international investments. The city's lower cost of living compared to Istanbul also allows companies to offer competitive salaries while maintaining affordable overhead. Izmir has positioned itself as a key player in

Turkey's growing tech scene, particularly for roles that require advanced technical skills in emerging fields.

- **Key Insight:** Tech professionals in Izmir benefit from relatively high salaries combined with a lower cost of living, making it an attractive destination for skilled professionals seeking a balanced lifestyle.

2. **Istanbul**

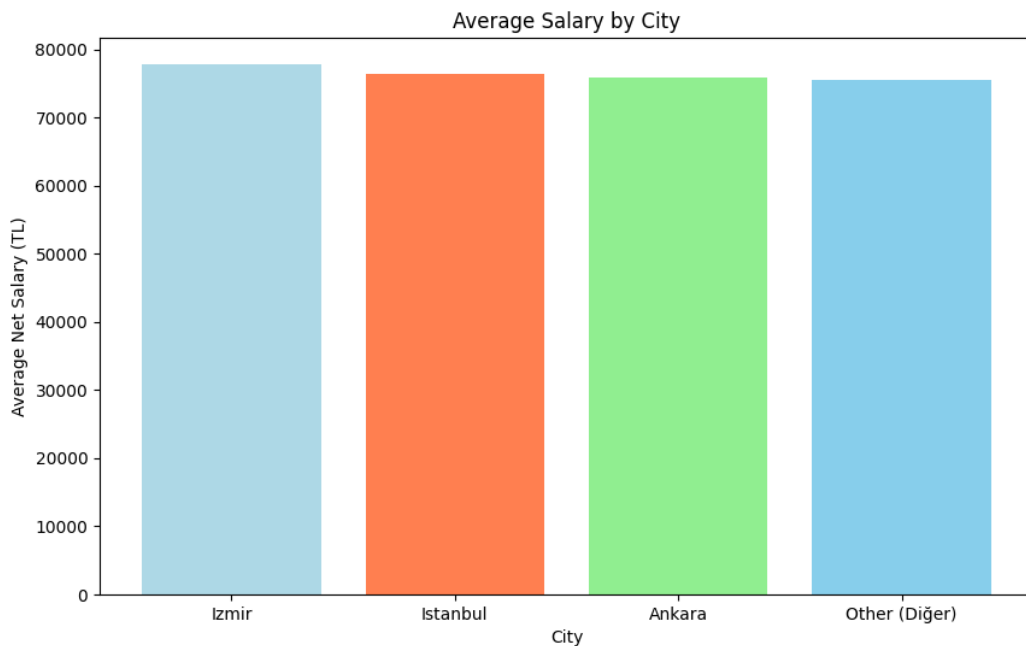
Istanbul, as the largest and most developed tech hub in Turkey, offers an average salary of **76,325 TL**. While Istanbul has a reputation for high-paying tech roles, the **cost of living** in the city—one of the highest in Turkey—may somewhat offset the salary advantages. Nevertheless, the city continues to be a magnet for tech talent, offering the largest number of job opportunities, networking prospects, and access to international markets.

- **Key Insight:** While Istanbul offers competitive salaries, the high cost of living means that professionals might need to consider this factor when evaluating overall job offers.

3. **Ankara and Other Cities**

Ankara and smaller cities, categorized as **Diğer** in the dataset, have average salaries of **75,895 TL** and **75,489 TL**, respectively. These cities have growing tech sectors, but they still lag Istanbul and Izmir in terms of salary offerings. The demand for tech professionals is lower, but the cost of living is also much lower, allowing professionals to enjoy a similar standard of living without the same financial pressures as in Istanbul.

- **Key Insight: Istanbul and Izmir** remain the top cities for high-paying tech roles, but Ankara and other regions provide solid opportunities for professionals looking for affordable living while still benefiting from Turkey's expanding tech industry.



Conclusion on Geography: The salary differences across cities highlight a key point: relocation decisions should consider both salary and cost of living. Professionals moving to cities with higher salaries like Istanbul should weigh these against the higher living expenses, while those in Izmir and Ankara may enjoy a better quality of life at a lower cost.

5.4 Salary Differences by Job Role

The specialization of job roles in Turkey's tech sector is another major factor influencing salary disparities (Ludo Fourrage, 2023). The analysis clearly shows that professionals working in high-demand, technically specialized fields command premium salaries:

1. Data Engineer

Data Engineers earn an average salary of **105,933 TL**, the highest among the job roles surveyed (Ludo Fourrage, 2023). Their expertise in managing and optimizing data architecture is crucial for tech companies, particularly in the booming fields of Big Data and Artificial Intelligence. As companies increasingly rely on data to drive decisions, the demand for data engineering professionals is soaring.

- **Key Insight: Data Engineers** with specialized skills in emerging technologies like cloud computing and data architecture are highly valued and command top salaries.

2. Data Science

Data Science professionals follow closely with an average salary of **90,417 TL**. Given the rapid growth in AI and machine learning, Data Science roles are among the most sought-after in the tech industry. These professionals are skilled in creating algorithms and statistical models that power machine learning applications, making them integral to companies aiming to harness the power of data.

- **Key Insight:** Data Science roles, especially those specializing in machine learning and AI, offer substantial salary opportunities due to the growing need for data-driven decision-making.

3. Machine Learning

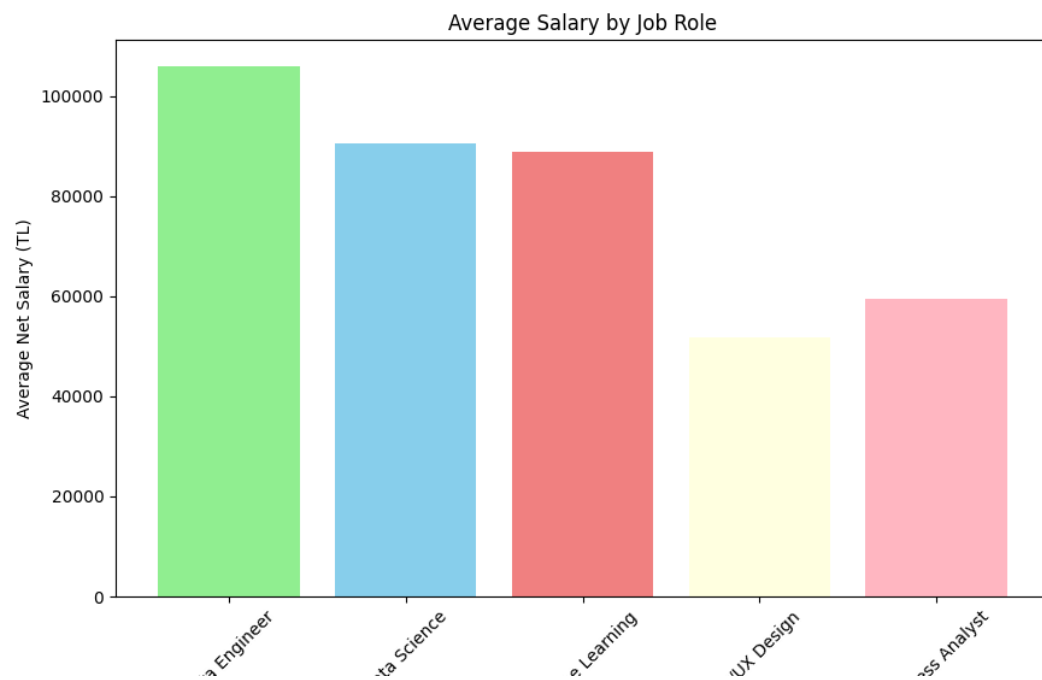
Professionals specializing in Machine Learning earn an average salary of **88,915 TL**. Their deep knowledge of AI, neural networks, and algorithm development makes them highly valuable to tech companies. As machine learning continues to disrupt industries across the globe, demand for skilled professionals in this field is only expected to grow.

- **Key Insight:** Professionals in machine learning and AI are in high demand, and their salary potential is expected to rise as the industry continues to expand.

4. Generalist Roles

Roles such as **UI/UX Design** (average salary: **51,733 TL**) and **Business Analyst** (average salary: **59,500 TL**) earn considerably lower salaries. While these positions are essential for tech companies, they are more generalist in nature and may not require the specialized skills and advanced technical knowledge that are associated with higher-paying roles in data engineering and machine learning.

- **Key Insight:** While generalist roles are essential for the overall functioning of tech companies, professionals in these fields can expect lower salaries compared to highly specialized roles like Data Engineering and Machine Learning.



Conclusion on Job Roles: Specializing in high-demand fields like Data Engineering, Data Science, and Machine Learning is financially rewarding, as these roles continue to see increasing demand and premium compensation. For tech professionals seeking career advancement, **upskilling** and transitioning into specialized areas can significantly boost earning potential.

5.5 Outliers and Unique Salary Combinations

While the average salaries provide a good general overview, the dataset also reveals several **outliers**—examples where individuals in specific roles or locations earn significantly more than the average:

1. Senior Data Engineer in Ankara

One outlier example includes a **Senior Data Engineer** based in Ankara who commands a salary as high as **210,000 TL**. This is well above the average for this role, reflecting the high demand for senior-level professionals in specialized fields, even in less competitive markets.

- **Key Insight:** This outlier demonstrates that location and specialization can lead to exceptional salary outcomes, even in smaller cities like Ankara.

2. Mid-Level Data Science Professional in Istanbul

Another outlier is a Mid-level Data Science professional in Istanbul who earns significantly more than their counterparts in other cities. The competitive market in Istanbul, combined with the high demand for Data Science professionals, drives up salaries for this role.

- **Key Insight: Location** remains a powerful factor in salary outcomes, and **Istanbul** continues to offer the highest salaries for tech roles due to its role as the nation's central tech hub.

6. Visualizations

6.1 Bar Chart: Average Salary by Experience Level

One of the most critical insights in this report is the direct relationship between experience and salary. A bar chart is an excellent tool to visually depict this trend, as it allows for a clear comparison between the salary averages of Junior, Mid, and Senior professionals.

Chart Description:

- The **x-axis** represents the **experience levels**: Junior, Mid, and Senior.
- The **y-axis** represents the **average net salary** in Turkish Lira (TL).
- Each bar represents the average salary for professionals at that specific experience level.



Insights:

- The **Senior category** has the tallest bar, reinforcing the finding that senior professionals, with their specialized skills and leadership experience, earn significantly higher than those at junior or mid-levels.
- The **Mid-level professionals** bar is notably shorter than the Senior one but taller than the Junior one, indicating the significant salary increase between the two levels.
- The **Junior professionals** bar is the shortest, reflecting their entry-level status and lower compensation, which increases substantially as they advance in their careers.

Implication:

This bar chart serves to visually emphasize the financial rewards of career progression in Turkey's tech sector. It encourages tech professionals to invest in developing specialized skills and gaining experience to achieve better salary outcomes.

Suggested Enhancements:

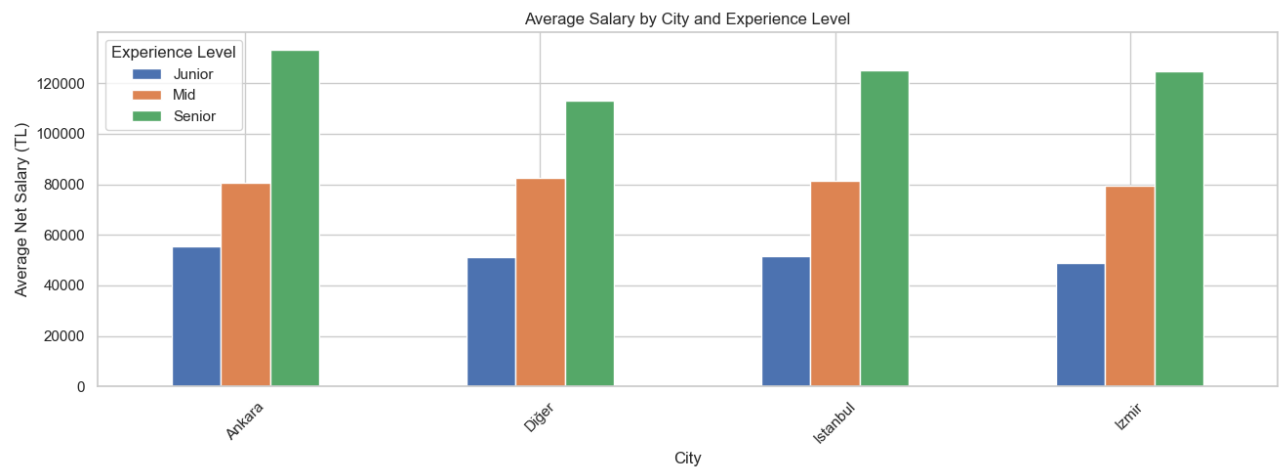
- We can add a **colour gradient** to each bar to highlight the salary increase from Junior to Senior, making it easier for readers to visualize the difference.
- A **trendline** could be added to show the overall salary trajectory as experience increases.

6.2 Grouped Bar Chart: Average Salary by City

A **grouped bar chart** can help us visually compare how salaries differ across the major tech cities in Turkey, such as **Istanbul**, **Izmir**, **Ankara**, and **Diğer** (Other cities). This chart will allow us to directly observe the geographical influence on salary trends.

Chart Description:

- The **x-axis** represents the cities: Istanbul, Izmir, Ankara, and Diğer.
- The **y-axis** represents the **average salary** in Turkish Lira (TL).
- Each city will have three bars representing the **Junior**, **Mid**, and **Senior** levels, providing a direct comparison across both geography and experience.



Insights:

- **Izmir** emerges as the highest-paying city, with salaries in both Junior and Senior roles slightly outpacing those in Istanbul. This could reflect the city's rising prominence in the tech ecosystem.
- **Istanbul**, while the largest tech hub, offers salaries that are somewhat lower than Izmir in certain categories, which could be attributed to the high cost of living in Istanbul, which might offset the salary advantage.
- **Ankara and Diğér** cities offer lower salaries compared to Istanbul and Izmir. However, they still show a notable variation between experience levels, with a particularly large salary gap between Junior and Senior professionals.

Implication:

This chart reveals that geographical location significantly impacts salaries, and that professionals considering relocation should factor in both salary and **cost of living** in each city. The rising salaries in Izmir suggest that emerging tech hubs can provide competitive compensation.

Suggested Enhancements:

- We could use different **colours** for each city to easily distinguish them in the grouped bars.
- Including a reference line for the national average salary would provide a benchmark for comparison.

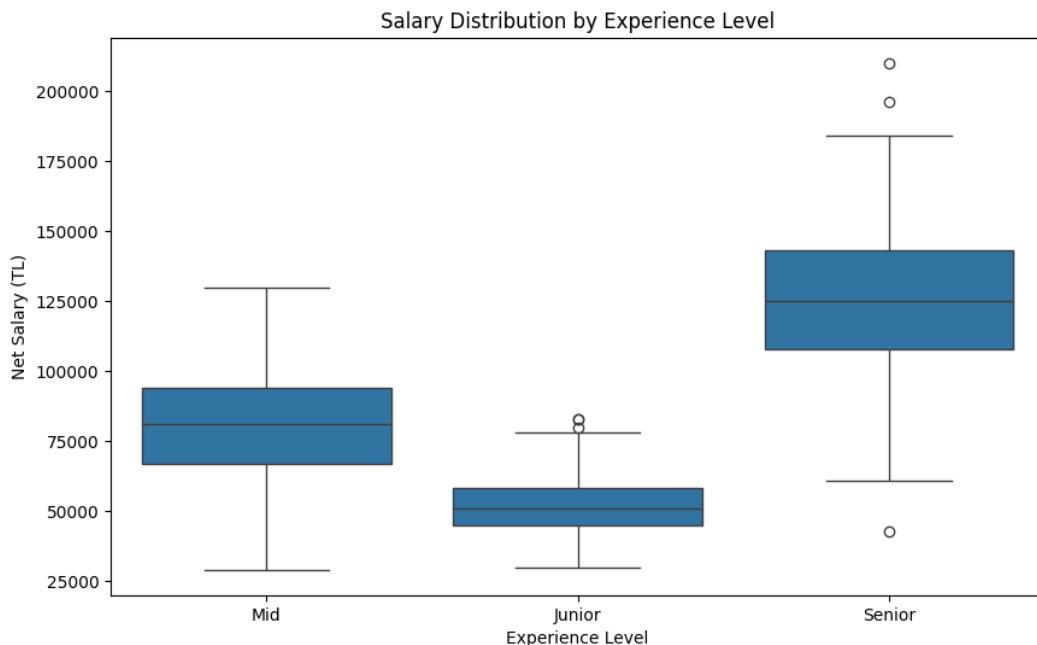
6.3 Box Plot: Salary Distribution by Experience Level

A **box plot** provides a more granular view of the salary distribution within each experience category. It offers key information about the range, spread, and outliers within the data, helping us understand not only the central tendency but also the variability.

Chart Description:

- The **x-axis** represents the **experience levels** (Junior, Mid, Senior).
- The **y-axis** represents the **salary distribution** (in TL).
- The **box** represents the **interquartile range (IQR)**, from the 25th percentile (Q1) to the 75th percentile (Q3), with a line at the median salary.

- **Whiskers** show the range of salaries, from the minimum to the maximum, excluding outliers.
- **Outliers** (if any) are plotted individually as points outside the whiskers.



Insights:

- The **box plot** clearly highlights the variability in salary within each experience level. Senior professionals have the widest range, with some commanding exceptionally high salaries, which could reflect outliers in high-demand roles or geographical discrepancies.
- The **Junior and Mid-level** categories show a more tight-knit salary range, indicating that most professionals in these levels are paid relatively similarly within each category.
- The presence of outliers in the Senior category is particularly notable, with some professionals earning much higher than the majority, especially in specialized roles like Data Engineering or Machine Learning.

Implication:

This visualization is useful for professionals and businesses alike, as it provides a deeper understanding of salary variability. For companies, understanding this variability helps them position themselves in the market effectively, while for professionals, it shows the range of

potential salaries within their career level and gives insight into how exceptional outliers are compensated.

Suggested Enhancements:

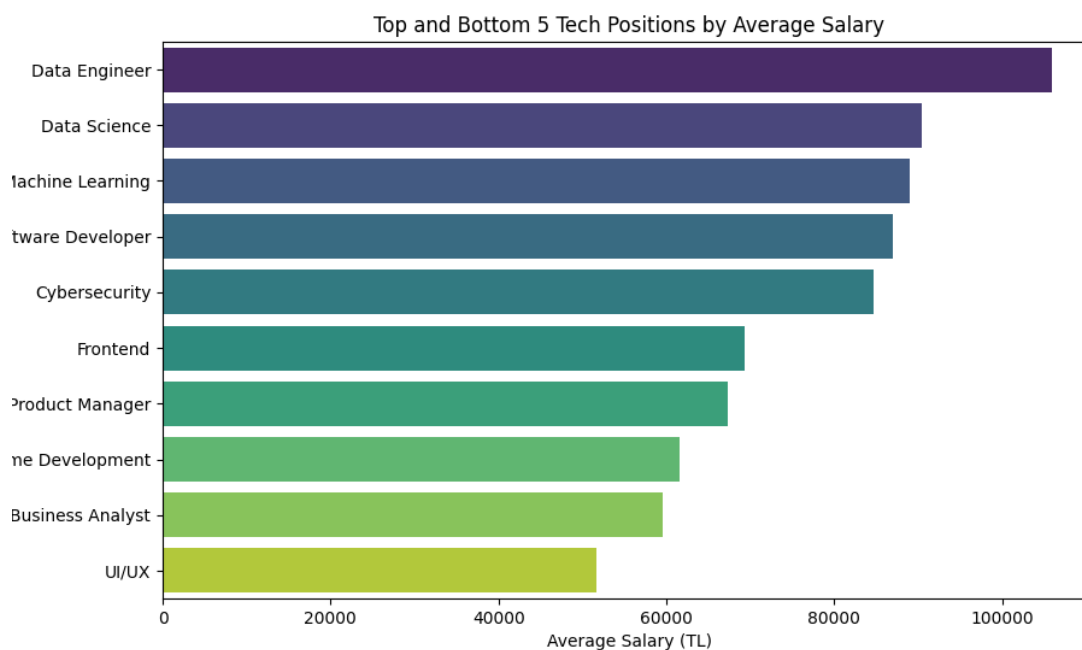
- The **whiskers** could be adjusted to show percentile ranges (e.g., 10th to 90th percentile), which would provide a more specific view of the salary distribution.
- **Annotations** could highlight specific outliers to provide context.

6.4 Top and Bottom 5 Positions: Horizontal Bar Chart

This **horizontal bar chart** will rank tech job roles based on their average salary. By using horizontal bars, we can clearly identify which positions command the highest salaries and which are at the lower end of the pay scale.

Chart Description:

- The **x-axis** represents the **average salary** in Turkish Lira (TL).
- The **y-axis** lists the **job positions** (Data Engineer, Data Science, Machine Learning, etc.).
- The bars are arranged in descending order, from the highest-paying roles to the lowest.



Insights:

- **Data Engineer** and **Data Science** professionals emerge as the highest-paid positions, with salaries exceeding **100,000 TL** on average.
- **Machine Learning** professionals follow closely, confirming the high demand for these specialized roles in the Turkish tech industry.
- On the lower end, roles like UI/UX Design and Business Analyst offer average salaries of around 50,000 TL, showing that generalist roles earn significantly less than specialized positions.

Implication:

This chart is crucial for tech professionals who are evaluating career paths or considering **specializations**. It highlights the financial benefits of specializing in emerging, high-demand technologies, such as Data Engineering and Machine Learning, over more generalist roles.

Suggested Enhancements:

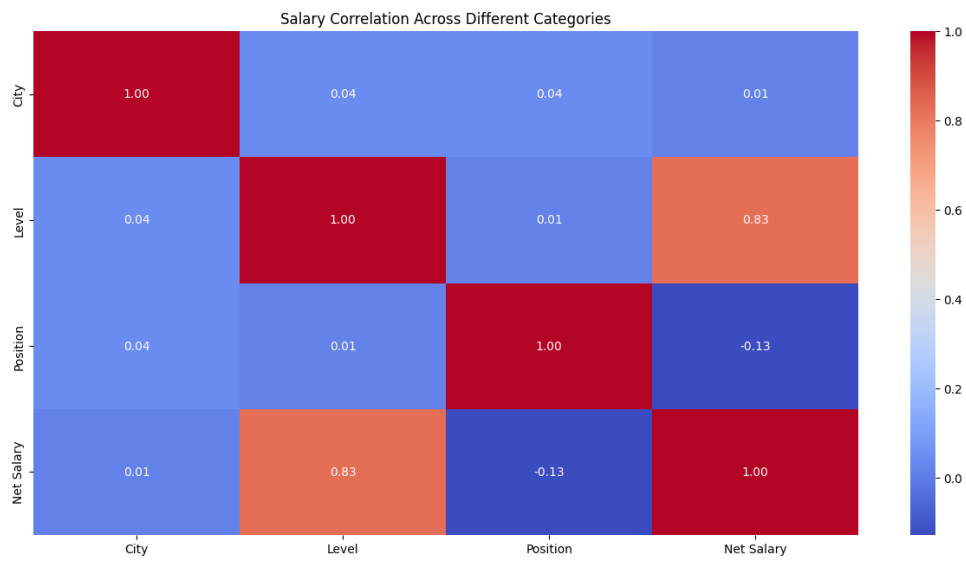
- Adding **color-coded bars** to differentiate between the top and bottom positions would make the chart easier to read.
- Including salary ranges within the bars would provide additional context.

Additional Suggested Visualizations:

To further enhance the report and provide more insights, we can include the following visualizations:

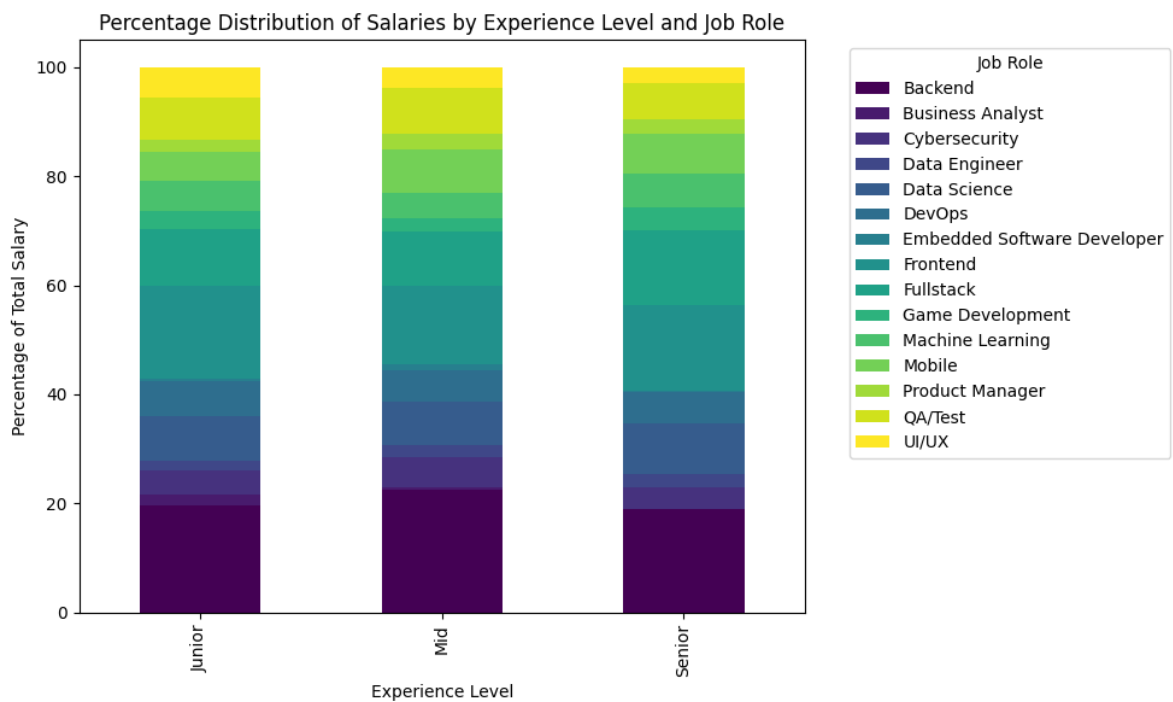
Heatmap: Salary Correlation Across Different Categories

- This heatmap would show the correlation between various variables (e.g., City, Position, and Experience Level) and their impact on salaries. It could highlight which combinations of city, experience level, and position offer the highest or lowest compensation.



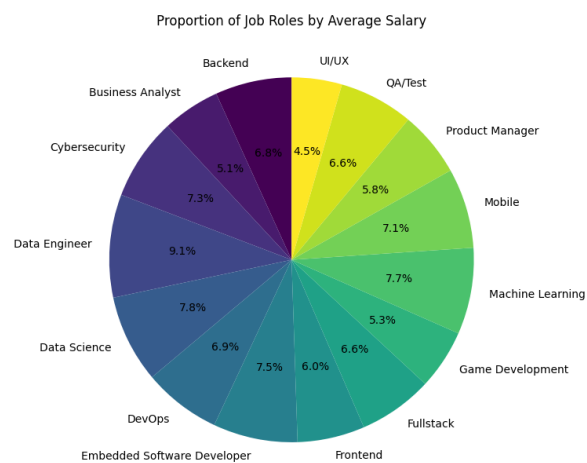
Stacked Bar Chart: Percentage Distribution of Salaries by Experience Level and Job Role

- This visualization could break down the salary percentages across various experience levels and job roles, giving a visual indication of the salary distribution within each category.



Pie Chart: Proportion of Job Roles by Average Salary

- A pie chart could visually depict the percentage share of different job roles (e.g., Data Engineer, Data Science, Backend Developer) in the total salary distribution. This would help illustrate which roles dominate the salary landscape.



Line Graph: Salary Growth Over Time for Different Job Roles

- This graph could show the salary trajectory for different positions over time, reflecting how salaries increase as professionals advance in their careers.



7. Conclusion and Recommendations

7.1 Summary of Key Insights

This report has provided a detailed analysis of the salary landscape in Turkey's rapidly growing tech sector. Through descriptive analytics and data visualization, several key insights have emerged that offer valuable guidance to both businesses and tech professionals in the country.

1. Experience Level Is the Dominant Factor in Determining Salary

The most significant insight from this analysis is the clear relationship between experience level and salary. As expected, Senior professionals command significantly higher salaries than their Junior and Mid-level counterparts. The data clearly shows that career progression has a direct financial reward, with Senior roles offering salaries that are more than double those of Junior positions. This emphasizes the importance of gaining expertise and experience in the tech sector, with salaries showing significant growth as professionals move up the ladder.

2. Geography Plays a Crucial Role

The geographical variation in salaries is another important finding. While Istanbul remains the primary tech hub of Turkey, Izmir surprisingly emerged as the city with the highest average salary. This suggests that while Istanbul has a larger pool of

opportunities, Izmir's growing tech ecosystem, fuelled by investments and startup initiatives, has created a highly competitive salary environment. Cities like Ankara and other smaller tech hubs (Diğer) offer lower average salaries, but there is still considerable potential for growth in these regions.

3. Specialized Roles Command Premium Salaries

Specialized roles in areas like Data Engineering, Data Science, and Machine Learning attract the highest salaries. These fields are in high demand due to the increasing reliance on data-driven decision-making in the tech industry. Conversely, more generalist roles, such as UI/UX Design and Business Analysis, are at the lower end of the salary spectrum. This finding highlights the financial benefits of specialization and choosing roles with high growth potential in emerging fields.

Together, these insights provide a holistic view of the current salary dynamics within Turkey's tech sector and underscore the importance of experience, geography, and specialization in shaping compensation levels.

7.2 Recommendations for Companies

Based on the findings of this analysis, several strategic recommendations can help companies optimize their compensation strategies, attract the best talent, and retain top-performing professionals in a highly competitive market. This includes benchmarking salaries against industry standards and geographical differences (Teammelon.co, 2025).

1. Review and Benchmark Salaries Regularly

Companies should conduct regular reviews of their salary structures to ensure they are offering competitive compensation. This includes benchmarking salaries against industry standards and geographical differences. As the tech sector continues to evolve, businesses need to stay updated with trends to avoid overpaying or underpaying employees. Investing in **salary surveys** or collaborating with third-party consultancies to collect accurate market data is essential.

Regular benchmarking ensures companies remain competitive and can effectively adjust compensation to attract and retain top talent.

2. Attract and Retain Talent by Offering Salary Premiums and Incentives

With the growing demand for professionals in fields like data engineering, data science, and machine learning, companies must consider offering salary premiums to

attract and retain high-demand talent. Incentives such as performance bonuses, stock options, or profit-sharing can also make positions more attractive. Additionally, companies should consider offering relocation bonuses to attract skilled professionals to cities with a lower cost of living but growing tech ecosystems, such as Izmir.

Offering competitive salaries is not just about paying well but also about providing value-added incentives that align with the expectations of modern tech professionals.

Consider Location-Specific Salary Strategies

Key Insight:

For businesses located outside of Istanbul and Izmir, where salaries are typically higher, it's essential to develop location-specific salary strategies to remain competitive in attracting top tech talent. While cities like Istanbul and Izmir offer higher salary averages due to the presence of large tech ecosystems and a higher cost of living, smaller cities such as Ankara, Bursa, and other regional hubs often struggle to match these salary levels.

However, this geographical salary disparity doesn't have to be a hindrance. Companies in these smaller or emerging tech hubs can adopt strategic adjustments to attract and retain top talent by making their compensation packages more competitive.

Location-Based Salary Adjustments

To bridge the salary gap between large tech hubs and smaller cities, companies can:

1. Offer Higher Salaries in Smaller Cities:

Even though the cost of living may be lower in cities like Ankara or Bursa, businesses can offer location-based salary adjustments to ensure that their compensation packages are attractive compared to the salary offerings in larger cities. This approach not only helps to bring in experienced professionals but also ensures retention of local talent.

2. Create Competitive Relocation Packages:

For tech companies based in smaller cities, providing attractive relocation packages can be an effective way to entice professionals from larger cities. These packages could include:

- Financial relocation assistance

- Housing support or subsidies
- Reimbursement for moving expenses
- Temporary accommodation options
- Relocation bonuses

Such packages would make it financially viable for professionals to relocate, especially if the salary in the new location compensates for the logistical challenges of moving.

3. Offer Non-Monetary Benefits:

For regions where companies may not be able to match the higher salary levels of Istanbul or Izmir, they can provide additional non-monetary benefits to sweeten the deal, such as:

- Remote work options or hybrid work models
- Flexible working hours
- Access to professional development resources (e.g., training, certifications, and mentorship programs)
- Opportunities for leadership roles or quicker career progression due to a smaller, more dynamic team

These benefits could help make a relocation offer more attractive and compensate for a salary gap.

Actionable Insights for Companies:

- **Tailor compensation packages** to local conditions, balancing between the cost of living and the competitive nature of larger cities.
- **Invest in talent mobility strategies** by offering relocation packages that make it easy for employees to transition to smaller cities.
- **Highlight the unique advantages** of living and working outside major tech hubs, such as a better quality of life, lower living costs, and opportunities for faster career progression in smaller teams.

Actionable Insights for Professionals:

- **Consider relocation opportunities** that offer not only a competitive salary but also additional benefits like career growth, cost of living advantages, and improved work-life balance.
- **Evaluate the long-term potential** of working in a smaller tech hub, where there might be greater opportunities for leadership roles, while still benefiting from an emerging tech ecosystem.

By strategically adjusting compensation to account for geographical differences, businesses in smaller tech hubs can compete with larger cities like Istanbul and Izmir for top-tier talent. Additionally, offering relocation incentives and focusing on the unique advantages of working outside major cities will make these regions more attractive to professionals seeking a balance between competitive salaries and a fulfilling lifestyle.

This approach not only enhances the talent pool but also helps businesses build strong, sustainable teams outside the highly competitive and saturated markets of the larger tech hubs.

7.3 Recommendations for Professionals

Tech professionals, especially those at the beginning of their careers, can use the findings from this report to make more informed decisions about career development, job roles, and geographical relocation. Here are some tailored recommendations:

1. Focus on Career Development and Specialization

For Junior professionals, it is essential to focus on developing specialized skills in high-demand fields like data engineering, machine learning, or data science. These roles command significantly higher salaries, and the demand for skilled professionals in these areas is expected to continue to grow. Participating in specialized training programs, bootcamps, or obtaining certifications in these emerging technologies can significantly increase earning potential over the long term.

Investing time in career development and acquiring advanced skills will pay off handsomely in terms of salary, job stability, and career satisfaction.

2. Relocation Considerations to Maximize Salary Potential

Professionals aiming to maximize their salary potential should consider relocating to Istanbul or Izmir, where the highest salaries are concentrated. The cost of living in Istanbul can be high, but the salaries are generally adjusted to reflect that. On the other hand, Izmir offers a competitive salary package without the high living costs of Istanbul, making it an attractive option for many tech professionals.

Relocation can be a key strategy for professionals who are looking to enhance their earning potential while also expanding their network and gaining exposure to more advanced projects and larger companies.

3. Leverage Salary Data for Effective Negotiation

Salary transparency is a crucial advantage for tech professionals. With a clearer understanding of industry standards, individuals can approach salary negotiations with greater confidence. For example, knowing that Data Engineers earn significantly higher than UI/UX Designers, professionals can tailor their career paths and negotiations to align with market expectations. If negotiating a job offer, candidates can use the benchmark salary data to advocate for a fair and competitive compensation package.

Armed with reliable data, tech professionals can make informed decisions about career moves, job offers, and negotiations, ensuring they receive appropriate compensation for their skills and experience.

7.4 Future Outlook

As Turkey's tech sector continues to grow and evolve, several key trends are expected to shape the salary landscape in the coming years. The growth of emerging technologies shifts in geographical trends and changing work preferences are all poised to significantly impact the market dynamics.

1. Expansion of Emerging Tech Roles

The rapid rise of technologies such as artificial intelligence (AI), cloud computing, and data analytics is reshaping the tech industry. This expansion is driving the need for specialized professionals in fields such as:

- **Machine Learning Engineers**
- **AI Specialists**
- **Cloud Architects**
- **Big Data Analysts**

As businesses increasingly adopt these technologies to stay competitive, demand for professionals with expertise in these areas will continue to grow. Salaries in these fields are expected to rise as the expertise required becomes rarer and more valuable. Professionals who specialize in these emerging technologies will have the potential for significant salary growth, driven by the high demand and relatively low supply of skilled workers.

Key Implication:

- **For businesses:** It will be crucial to offer competitive salaries to attract top talent in AI, machine learning, and cloud computing, which are expected to remain at the forefront of technological transformation.
- **For professionals:** Those who invest in upskilling and specialize in these high-demand technologies will likely see their salaries increase along with the growing demand.

2. Geographical Shifts in the Tech Landscape

As tech ecosystems in cities like Izmir and Ankara continue to expand, we may witness a more equitable distribution of tech talent and salaries across Turkey. While Istanbul has historically dominated the tech scene, the rapid development of regional tech hubs is likely to:

- **Increase local job opportunities** in cities like Izmir and Ankara.
- **Reduce salary discrepancies** between Istanbul and other cities, as smaller hubs offer competitive salaries to attract skilled professionals.

The emergence of regional tech hubs means that Istanbul's role as the dominant tech city may be challenged, as professionals consider the benefits of working in less saturated markets with a lower cost of living. This could lead to a more balanced tech talent distribution, benefiting smaller cities and improving the overall competitiveness of Turkey's tech industry.

Key Implication:

- **For businesses:** Companies outside Istanbul will need to adapt their compensation strategies to stay competitive in attracting talent from larger cities. Location-based salary strategies and relocation packages may become more common.
- **For professionals:** The rise of regional hubs offers opportunities for professionals to work in growing tech sectors without the high living costs of Istanbul, thus balancing salary expectations with lifestyle preferences.

3. Increased Focus on Work-Life Balance

As **remote work** continues to shape the future of the tech industry, work-life balance will become an increasingly important factor in compensation packages. Companies may place more emphasis on offering:

- **Flexible working hours:** Allowing employees to manage their work schedule in a way that suits their personal lives.
- **Remote work options:** Enabling employees to work from home or from anywhere, further promoting work-life integration.
- **Remote work stipends:** Providing financial support for home office setups, internet costs, or travel expenses.

As salary growth slows in certain areas due to market saturation, these non-monetary benefits may play a more significant role in attracting and retaining top talent. Companies that offer comprehensive work-life balance packages will likely gain a competitive advantage in the talent market.

Key Implication:

- **For businesses:** A focus on non-monetary benefits, such as work flexibility and remote work options, will become a major selling point for top talent, especially as salaries begin to plateau in certain regions.
- **For professionals:** As remote work continues to be a standard offering, professionals will likely prioritize companies that offer the flexibility to balance personal and professional life.

7.5 Final Thoughts

In conclusion, the salary dynamics within Turkey's tech sector are shaped by several interrelated factors: experience level, geography, specialization, and work preferences.

Key Takeaways:

- **Experience Level:** Senior professionals will continue to command higher salaries, with a clear financial incentive to gain expertise and experience. Career progression remains a strong driver of salary growth.
- **Geographical Influence:** While Istanbul and Izmir continue to offer the highest-paying roles, cities like Ankara and smaller tech hubs are emerging as competitive alternatives, offering both affordable living and growing career opportunities.
- **Specialization Pays Off:** Roles in emerging technologies like AI, data science, and machine learning offer the highest salary potential. Professionals who specialize in these high-demand fields will see continued growth in compensation as these sectors expand.
- **Work-Life Balance:** As remote work becomes more entrenched, the importance of non-monetary benefits, including flexibility and work-life integration, will play a central role in salary negotiations and retention.

For Businesses:

- Tailoring compensation strategies to account for location-based salary disparities is essential.
- **Investing in specialized roles** and offering remote work or flexible schedules will be key to attracting and retaining top talent.
- **Geographic diversification of talent** will help companies stay competitive as tech hubs in smaller cities grow.

For Professionals:

- **Continued learning** in specialized, high-demand fields like AI and machine learning will offer the best salary prospects.
- Embracing work-life balance and considering relocation to smaller hubs could offer both financial rewards and a better quality of life.

By understanding these trends, businesses can design more effective compensation strategies, and professionals can make more informed career decisions, leading to a more robust, competitive, and equitable tech ecosystem in Turkey.

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Data Source Link

<https://www.kaggle.com/datasets/alibakirx/software-engineer-salaries-tr-2025>

Python Scripts for Data Analysis and Visualizations

The following Python scripts, utilizing libraries such as Pandas, Seaborn, and Matplotlib, served as the analytical framework for this report and its corresponding visualizations.

Python

```
import pandas as pd
```

```
import matplotlib.pyplot as plt
```

```
import seaborn as sns
```

```
# Load dataset
```

```
df = pd.read_csv("dataset_realistic.csv", delimiter=";")
```

```
# Clean column names
```

```
df.columns = df.columns.str.strip().str.lower().str.replace(" ", "_").str.replace("(",  
""").str.replace(")", "")
```

```
sns.set(style="whitegrid") # nice background for plots
```

1. Salary Distribution and Average Salary Visualizations

1.1. Salary Distribution by City (Boxplot)

Python

```
plt.figure(figsize=(8,5))
```

```
sns.boxplot(x='city', y='net_salary', data=df, palette="Set2")
```

```
plt.title("Salary Distribution by City")
```

```
plt.xlabel("City")
```

```
plt.ylabel("Net Salary (TL)")
```

```
plt.xticks(rotation=45)
```

```
plt.tight_layout()
```

```
plt.show()
```

1.2. Average Salary by City (Bar Chart)

Python

```
avg_salary_city = df.groupby('city')['net_salary'].mean().sort_values(ascending=False)
```

```
plt.figure(figsize=(8,5))
```

```
sns.barplot(x=avg_salary_city.index, y=avg_salary_city.values, palette="Blues_d")
```

```
plt.title("Average Salary by City")
```

```
plt.xlabel("City")
```

```
plt.ylabel("Average Net Salary (TL)")
```

```
plt.xticks(rotation=45)
```

```
plt.tight_layout()
```

```
plt.show()
```

1.3. Salary Distribution by Experience Level (Boxplot)

Python

```
plt.figure(figsize=(6,5))
```

```
sns.boxplot(x='level', y='net_salary', data=df, palette="Set3")
```

```
plt.title("Salary Distribution by Experience Level")
```

```
plt.xlabel("Experience Level")
```

```
plt.ylabel("Net Salary (TL)")
```

```
plt.tight_layout()
```

```
plt.show()
```

1.4. Average Salary by Experience Level (Bar Chart)

Python

```
avg_salary_level = df.groupby('level')['net_salary'].mean().sort_values(ascending=False)
```

```
plt.figure(figsize=(6,5))
```

```
sns.barplot(x=avg_salary_level.index, y=avg_salary_level.values, palette="Pastel1")
```

```
plt.title("Average Salary by Experience Level")
```

```
plt.xlabel("Experience Level")
```

```
plt.ylabel("Average Net Salary (TL)")
```

```
plt.tight_layout()
```

```
plt.show()
```

2. Position and Grouped Visualizations

2.1. Average Salary by Position / Job Role (Bar Chart)

Python

```
avg_salary_position =
```

```
df.groupby('position')['net_salary'].mean().sort_values(ascending=False)
```

```
plt.figure(figsize=(10,5))
```

```
sns.barplot(x=avg_salary_position.index, y=avg_salary_position.values, palette="coolwarm")
```

```
plt.title("Average Salary by Position")
```

```
plt.xlabel("Position")
```

```
plt.ylabel("Average Net Salary (TL)")
```

```
plt.xticks(rotation=45)
```

```
plt.tight_layout()
```

```
plt.show()
```

2.2. Top 5 and Bottom 5 Positions by Average Salary

Python

```
top_5 = avg_salary_position.head(5)
```

```
bottom_5 = avg_salary_position.tail(5)
```

```
plt.figure(figsize=(10,5))
```

```
sns.barplot(x=top_5.index, y=top_5.values, palette="Greens_d")
```

```
plt.title("Top 5 Tech Positions by Average Salary")
```

```
plt.ylabel("Average Net Salary (TL)")
```

```
plt.xticks(rotation=45)
```

```
plt.tight_layout()
```

```
plt.show()
```

```
plt.figure(figsize=(10,5))
```

```
sns.barplot(x=bottom_5.index, y=bottom_5.values, palette="Reds_d")
```

```
plt.title("Bottom 5 Tech Positions by Average Salary")
```

```
plt.ylabel("Average Net Salary (TL)")
```

```
plt.xticks(rotation=45)
```

```
plt.tight_layout()
```

```
plt.show()
```

2.3. Average Salary by City and Experience Level (Grouped Bar Chart)

Python

```
avg_salary_city_level = df.groupby(['city', 'level'])['net_salary'].mean().unstack()

avg_salary_city_level.plot(kind='bar', figsize=(10,5))

plt.title("Average Salary by City and Experience Level")

plt.xlabel("City")

plt.ylabel("Average Net Salary (TL)")

plt.xticks(rotation=45)

plt.legend(title="Experience Level")

plt.tight_layout()

plt.show()
```

3. Advanced and Categorical Visualizations

3.1. Salary Correlation Across Categories (Pivot Heatmap)

Python

```
# Convert categorical levels to codes for correlation

df_corr = df.copy()

df_corr['level_code'] = df_corr['level'].astype('category').cat.codes

df_corr['city_code'] = df_corr['city'].astype('category').cat.codes

df_corr['position_code'] = df_corr['position'].astype('category').cat.codes


corr = df_corr[['net_salary', 'level_code', 'city_code', 'position_code']].corr()


plt.figure(figsize=(6,5))

sns.heatmap(corr, annot=True, cmap="coolwarm")
```

```
plt.title("Correlation of Salary with Categories")
```

```
plt.tight_layout()
```

```
plt.show()
```

3.2. Percentage Distribution of Professionals by Level (Pie Chart)

Python

```
level_counts = df['level'].value_counts(normalize=True) * 100
```

```
plt.figure(figsize=(6,6))
```

```
level_counts.plot(kind='pie', autopct='%1.1f%%', startangle=90,  
colors=sns.color_palette("Pastel2"))
```

```
plt.ylabel("")
```

```
plt.title("Percentage of Professionals by Experience Level")
```

```
plt.tight_layout()
```

```
plt.show()
```

3.3. Percentage Distribution of Professionals by Job Role (Pie Chart)

Python

```
role_counts = df['position'].value_counts(normalize=True) * 100
```

```
plt.figure(figsize=(6,6))
```

```
role_counts.plot(kind='pie', autopct='%1.1f%%', startangle=90,  
colors=sns.color_palette("Set3"))
```

```
plt.ylabel("")
```

```
plt.title("Percentage of Professionals by Job Role")
```

```
plt.tight_layout()
```

```
plt.show()
```

3.4. Proportion of Average Salary by Job Role (Pie Chart)

Python

```
avg_salary_position.plot(kind='pie', autopct='%1.1f%%', figsize=(7,7), startangle=90,
cmap='tab20')

plt.ylabel("")

plt.title("Proportion of Average Salary by Job Role")

plt.tight_layout()

plt.show()
```

3.5. Salary Growth by Experience Level for Job Roles (Line Chart)

Python

```
avg_salary_role_level = df.groupby(['position', 'level'])['net_salary'].mean().unstack()

avg_salary_role_level.plot(kind='line', marker='o', figsize=(10,6))

plt.title("Salary Growth by Experience Level for Different Job Roles")

plt.xlabel("Job Role")

plt.ylabel("Average Salary (TL)")

plt.xticks(rotation=45)

plt.legend(title="Experience Level")

plt.tight_layout()

plt.show()
```

4. Summary Statistics and Breakdowns

4.1. Average Salary by Category

Python

1. Average by Level

```
average_salary_by_level = df.groupby('level')['net_salary'].mean()

print("\nAverage Annual Salary by Level (TL):")

print(average_salary_by_level.round(2))
```

2. Average by City

```
average_salary_by_city = df.groupby('city')['net_salary'].mean()

print("\nAverage Annual Salary by City (TL):")

print(average_salary_by_city.round(2))
```

3. Average by Position

```
average_salary_by_role = df.groupby('position')['net_salary'].mean()

print("\nAverage Annual Salary by Role (TL):")

print(average_salary_by_role.round(2))
```

4.2. Summary of Numerical Variables

Python

```
print("==== Summary of Numerical Variables =====")

print(df.describe().round(2))
```

4.3. Unique Values per Column

Python

```
print("==== Unique Values per Column =====")

for col in df.columns:

    print(f"\nColumn: {col}")

    print("Unique values:", df[col].nunique())

    print(df[col].unique())
```


4.4. Number of Professionals per City (Bar Chart)

Python

```
# Count number of professionals per city

city_counts = df['city'].value_counts()


# Plot

plt.figure(figsize=(8,5))

sns.barplot(x=city_counts.index, y=city_counts.values, palette="viridis")

plt.title("Number of Tech Professionals per City", fontsize=14)

plt.xlabel("City", fontsize=12)

plt.ylabel("Number of Professionals", fontsize=12)

plt.xticks(rotation=45)

plt.tight_layout()

plt.show()
```

4.5. Level, Position, and City Breakdowns (Console Output)

Python

```
print("==== Level Breakdown =====")

print(df['level'].value_counts())


print("\n==== Position Breakdown =====")

print(df['position'].value_counts())


print("\n==== City Breakdown =====")

print(df['city'].value_counts())
```


Turkey's Tech Salary Landscape (2025)

Benchmark insights from 1,000 tech professionals

- Focus: roles, regions, experience

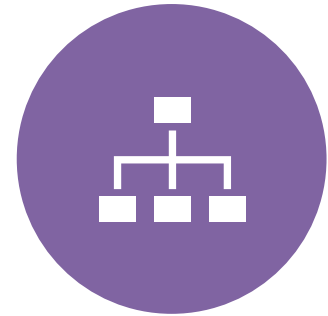
Executive Summary



RAPID SECTOR GROWTH AND DIGITAL
TRANSFORMATION; TECH NOW
CENTRAL TO ECONOMIC
DEVELOPMENT



CORE CHALLENGE: LACK OF
STANDARDIZED, TRANSPARENT SALARY
DATA ACROSS TURKEY



REPORT BENCHMARKS SALARIES BY
CITY, ROLE, AND EXPERIENCE USING A
STRUCTURED ANALYTICS LIFECYCLE

Key Findings at a Glance

Experience premium: Senior avg. 124,111 TL; Mid 81,300 TL; Junior 51,972 TL

Regional disparities: Izmir leads with 128,500 TL, then Istanbul with 121,000 TL, and Ankara with 106,000 TL

Role premiums: Data Engineering, Data Science, Machine Learning regularly exceed 100,000 TL

The Transparency Gap



No standardized, accessible salary data → inefficient hiring & retention



Professionals struggle to benchmark offers and negotiate fairly



Impacts equity, mobility, and strategic workforce planning

Turkey's Tech Sector Growth



STARTUPS (GETIR,
TRENDYOL, PEAK GAMES) +
GLOBAL INVESTORS DRIVE
MOMENTUM



ECOSYSTEM SPANS
SOFTWARE, E-COMMERCE,
FINTECH, CLOUD, DIGITAL
SERVICES



GOVERNMENT SUPPORT
TDZS, INCENTIVES; >10,000
CS GRADS/YEAR



RISING FDI

Data & Scope

Sample: 1,000 tech professionals with varied roles, cities, experience.

Primary dataset: Kaggle 'Software Engineer Salaries TR 2025'

Variables: City, Experience Level (Junior/Mid/Senior), Position, Net Salary in Turkish Lira

Analytics Lifecycle & Methods

Descriptive analytics

(mean, median,
min/max, std dev)

- Grouping by City, Experience, Position for granular insights
- Tools: Python/pandas ,visual concept designs

Experience Premium



Senior avg



124,111 TL -leadership,
specialization,
decision-making

Mid avg



81,300 TL -increasing
responsibility, mentoring

Junior avg



51,972 TL -entry roles with strong growth
trajectory

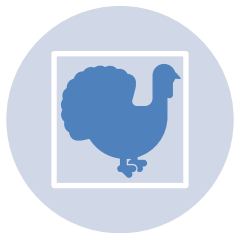
Geographical Differences



Izmir -highest average
77,818 TL overall; tops
selected bands



Istanbul -76,325 TL;
vast opportunity set
but higher living costs



Ankara -75,895 TL;



Other cities 75,489 TL;
lower costs, growing
hubs

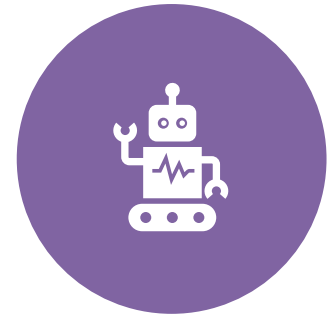
High-Demand Roles



DATA ENGINEER AVG-
105,933 TL (DATA
ARCHITECTURE & PIPELINES)



DATA SCIENCE AVG - 90,417
TL (ML & ANALYTICS FOR
DECISIONS)



MACHINE LEARNING AVG -
88,915 TL (AI/ML MODEL
DEVELOPMENT)

Generalist Roles & Pay



Business Analyst avg -
59,500 TL

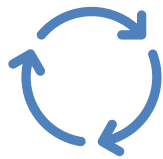


UI/UX Design avg - 51,733
TL

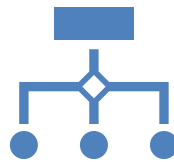


Essential roles but lower
averages vs. data/ML
specialties

Entry-Level & Mid-Career Benchmarks



Junior (0–2 yrs) avg -
51,972 TL → set realistic
starting offers



Mid (3–5 yrs) avg - 81,300
TL → robust but not linear
growth



-Potential mid-level
compression suggests
retention risk

Outliers Worth Noting



SENIOR DATA ENGINEER IN
ANKARA EARN UP TO EARN
210,000 TL



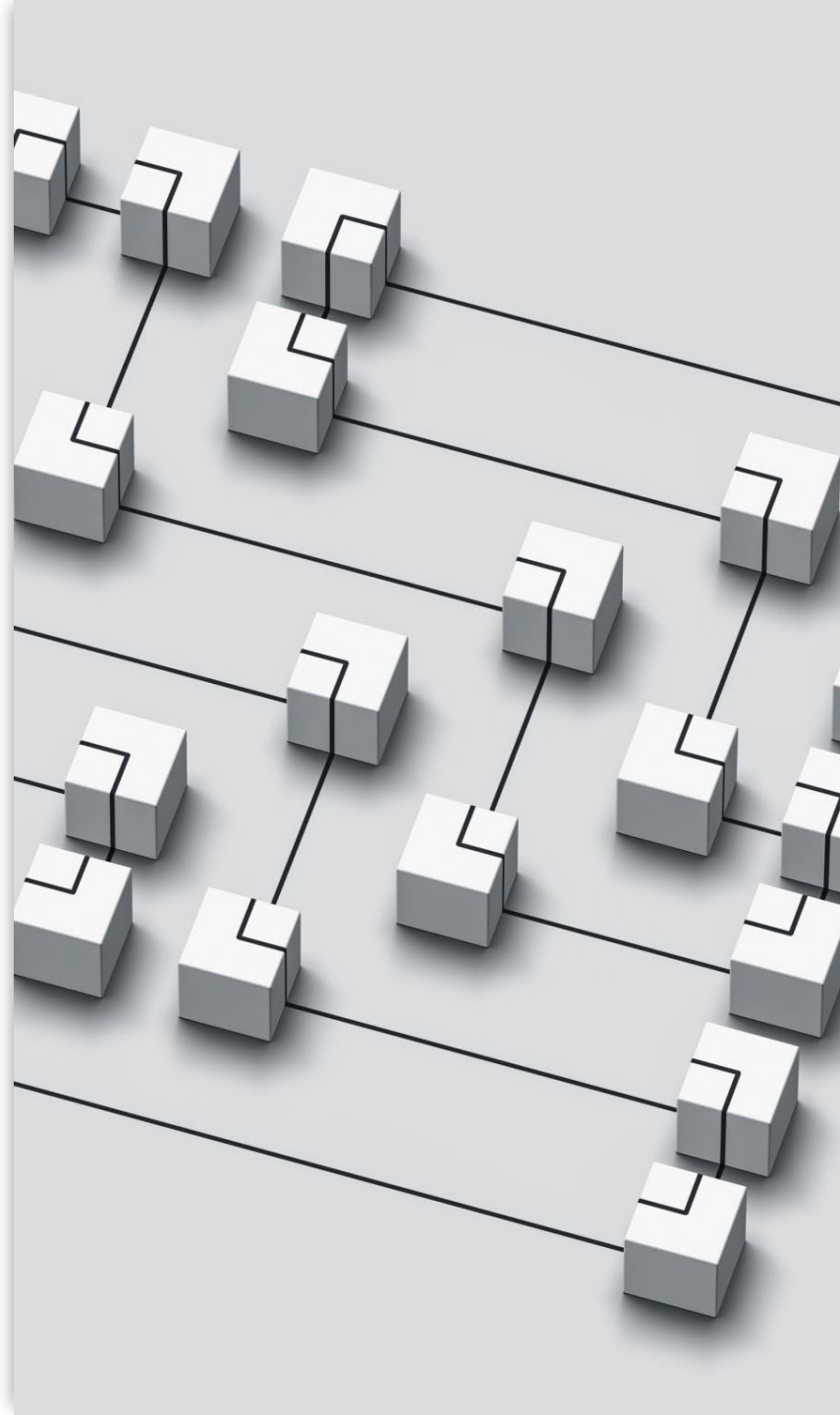
MID-LEVEL DATA SCIENTIST
IN ISTANBUL ABOVE
GROUP NORMS



LOCATION +
SPECIALIZATION CAN DRIVE
EXCEPTIONAL PACKAGES

Preprocessing & Validation

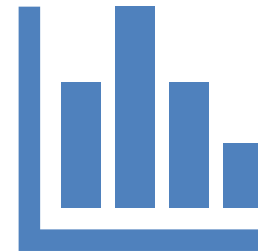
- CSV data → pandas; standardized columns e.g., Position, Salary
- Validated datatypes; consistent categories (City, Level, Position)
- No missing values observed; normalization by location/level



Visualizations Used (Concepts)



Bar chart: Avg salary by
experience (Junior/Mid/Senior)



Grouped bars: City × Level
comparisons

City x Experience Highlights

Senior level

-Ankara :133,308 TL;

-Istanbul :125,181 TL;

-Izmir :124,739 TL;

-Other ,113,000 TL

- Mid level ranges -79,438 to 82,506 TL across cities
- Junior level- 48,737 to 55,598 TL across cities

Role Rankings by Average Salary

1) Data Engineer

2) Data Science

3) Machine Learning

- Backend > Frontend on average; data roles lead overall
- Generalist roles trail specialized data/ML tracks

Implications for Employers

Benchmark regularly;
align offers to market &
geography

Premiums for data/ML
roles; use bonuses,
equity, mobility

Location-specific
strategies; relocation and
non-cash benefits

Implications for Professionals



INVEST IN SPECIALIZATION
THAT IS DATA ENG, MACHINE
LEARNING, AI AND CLOUD.



CONSIDER RELOCATION TO
ISTANBUL OR IZMIR VS.
COST-OF-LIVING TRADEOFFS



LEVERAGE BENCHMARKS TO
NEGOTIATE FAIR
COMPENSATION

Future Outlook & Final Recommendations



EMERGING TECH (AI, CLOUD,
BIG DATA) WILL PUSH
PREMIUM ROLES HIGHER



REGIONAL HUBS MATURING
→ MORE BALANCED SALARY
MAP OVER TIME



NON-MONETARY BENEFITS
(FLEXIBILITY, REMOTE)
GROW IN IMPORTANCE

Chart: Average Salary by Experience Level



Chart: Average Salary by City × Experience

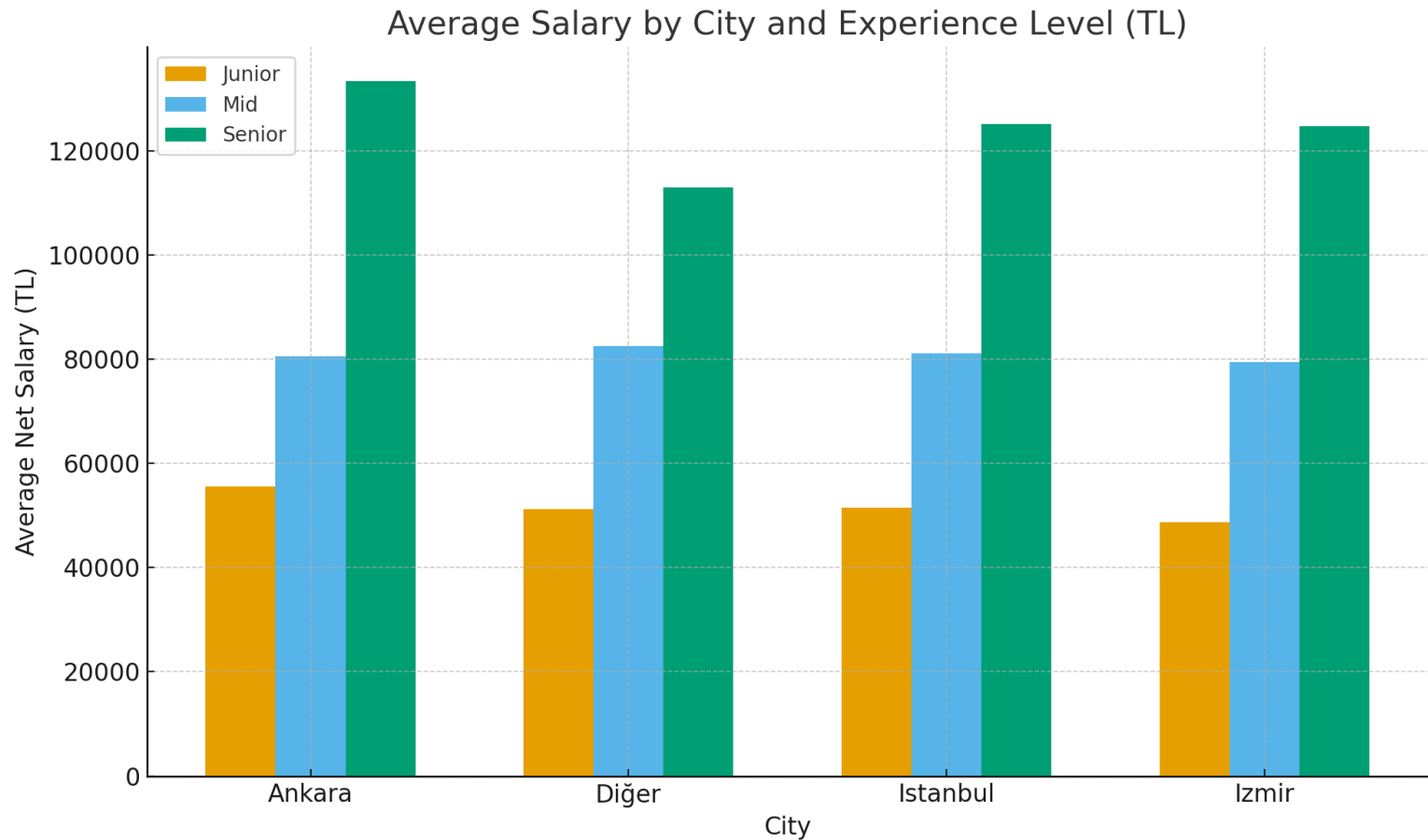


Chart: Average Salary by Role (Ranking)

