

# **IBM HR ANALYTICS ( EMPLOYEE ATTRITION AND PERFORMANCE ANALYSIS)**

**OBJECTIVE:** To analyze and identify the key factors contributing to employee attrition at the company, and to provide actionable insights and recommendations to reduce turnover rates and improve employee retention strategies.

**BACKGROUND:** Employee attrition is a critical issue for many organizations as it leads to increased recruitment and training costs, loss of institutional knowledge, and disruption of team dynamics. Understanding the reasons behind employee attrition and identifying patterns and trends can help organizations develop effective retention strategies.

**DATASET DESCRIPTION:** The IBM HR Analytics Employee Attrition and Performance dataset contains various attributes related to employee demographics, job roles, performance, and attrition status. Key columns in dataset include:

- **Age:** Age of the employee.
- **Attrition:** Whether the employee has left the company (Yes or No).
- **BusinessTravel:** Frequency of travel for business purposes (e.g., Travel\_Rarely, Travel\_Frequently, Non-Travel).
- **DailyRate:** Daily rate of the employee.
- **Department:** Department in which the employee works (e.g., Sales, Research & Development, Human Resources).
- **DistanceFromHome:** Distance from home to workplace.
- **Education:** Education level (e.g., 1 = 'Below College', 2 = 'College', 3 = 'Bachelor', 4 = 'Master', 5 = 'Doctor').
- **EducationField:** Field of education (e.g., Life Sciences, Other, Medical, Marketing, Technical Degree, Human Resources).
- **EmployeeCount:** Number of employees (constant value of 1 for all records).
- **EmployeeNumber:** Unique identifier for each employee.
- **EnvironmentSatisfaction:** Satisfaction with the environment (e.g., 1 = 'Low', 2 = 'Medium', 3 = 'High', 4 = 'Very High').
- **Gender:** Gender of the employee (Male or Female).
- **HourlyRate:** Hourly rate of the employee.
- **JobInvolvement:** Level of involvement in the job (e.g., 1 = 'Low', 2 = 'Medium', 3 = 'High', 4 = 'Very High').
- **JobLevel:** Job level within the organization.
- **JobRole:** Role of the employee within the company (e.g., Sales Executive, Research Scientist).

- **JobSatisfaction:** Level of job satisfaction (e.g., 1 = 'Low', 2 = 'Medium', 3 = 'High', 4 = 'Very High').
- **MaritalStatus:** Marital status of the employee (e.g., Single, Married, Divorced).
- **MonthlyIncome:** Monthly income of the employee.
- **MonthlyRate:** Monthly rate of the employee.
- **NumCompaniesWorked:** Number of companies the employee has worked for.
- **Over18:** Whether the employee is over 18 years old (constant value of 'Y' for all records).
- **OverTime:** Whether the employee works overtime (Yes or No).
- **PercentSalaryHike:** Percentage increase in salary.
- **PerformanceRating:** Performance rating (e.g., 1 = 'Low', 2 = 'Good', 3 = 'Excellent', 4 = 'Outstanding').
- **RelationshipSatisfaction:** Level of satisfaction with relationships at work (e.g., 1 = 'Low', 2 = 'Medium', 3 = 'High', 4 = 'Very High').
- **StandardHours:** Standard hours worked (constant value of 80 for all records)
- **StockOptionLevel:** Level of stock options granted (e.g., 0, 1, 2, 3).
- **TotalWorkingYears:** Total years the employee has worked.
- **TrainingTimesLastYear:** Number of times the employee has participated in training in the last year.
- **WorkLifeBalance:** Work-life balance rating (e.g., 1 = 'Bad', 2 = 'Good', 3 = 'Better', 4 = 'Best').
- **YearsAtCompany:** Total years the employee has been with the company.
- **YearsInCurrentRole:** Total years the employee has been in their current role.
- **YearsSinceLastPromotion:** Years since the employee's last promotion.
- **YearsWithCurrManager:** Years the employee has worked with their current manager.

**DATA CLEANING AND PREPROCESSING:** This is the very first and crucial step in data analysis. So first we are going to analyze data for any missing values.

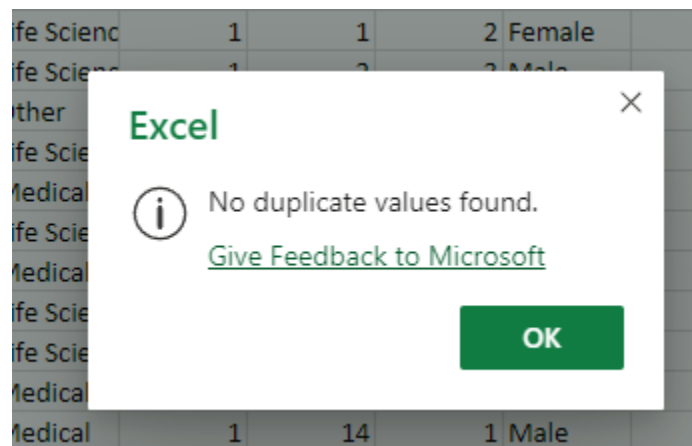
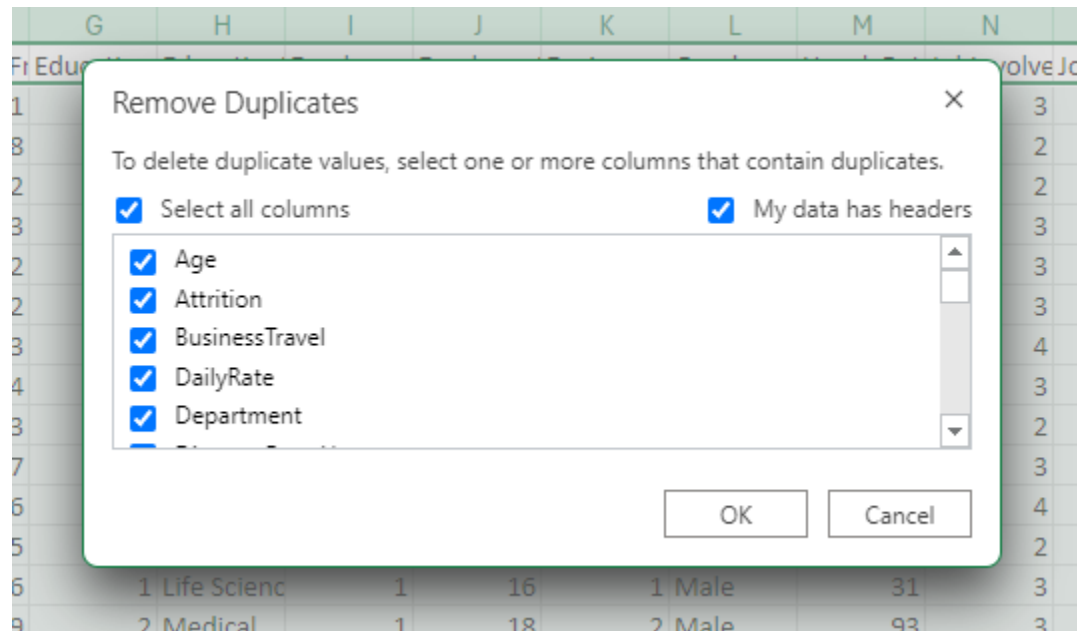
### Missing Values:

`=IF(COUNTA(A2:AI2)<COLUMNS(A2:AI2), "Missing", "Complete")`

=IF(COUNTA(A2:AI2)<COLUMNS(A2:AI2), "Missing", "Complete")														
V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
er18	OverTime	PercentSa	Performar	Relationsh	StandardH	StockOptic	TotalWork	TrainingTir	WorkLifeB	YearsAtCo	YearsInCur	YearsSince	YearsWith	Missing Va
	Yes	11	3	1	80	0	8	0	1	6	4	0	5	Complete
	No	23	4	4	80	1	10	3	3	10	7	1	7	Complete
	Yes	15	3	2	80	0	7	3	3	0	0	0	0	Complete
	Yes	11	3	3	80	0	8	3	3	8	7	3	0	Complete
	No	12	3	4	80	1	6	3	3	2	2	2	2	Complete
	No	13	3	3	80	0	8	2	2	7	7	3	6	Complete
	Yes	20	4	1	80	3	12	3	2	1	0	0	0	Complete
	No	22	4	2	80	1	1	2	3	1	0	0	0	Complete
	No	21	4	2	80	0	10	2	3	9	7	1	8	Complete
	No	13	3	2	80	2	17	3	2	7	7	7	7	Complete
	No	13	3	3	80	1	6	5	3	5	4	0	3	Complete
	Yes	12	3	4	80	0	10	3	3	9	5	0	8	Complete
	No	17	3	4	80	1	5	1	2	5	2	4	3	Complete
	No	11	3	3	80	1	3	2	3	2	2	1	2	Complete
	Yes	14	3	2	80	0	6	4	3	4	2	0	3	Complete
	No	11	3	3	80	1	10	1	3	10	9	8	8	Complete

There are no missing values in the data set. It is clean.

**Remove Duplicates:** Now we are going to check for duplicates and remove them.



There were no duplicates values.

**DESCRIPTIVE STATISTICS:** Descriptive statistics refers to a set of methods used to summarize and describe the main features of a dataset, such as its central tendency, variability, and distribution. These methods provide an overview of the data and help identify patterns and relationships.

```
=AVERAGE(in!A2:in!A1471)
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```
=MEDIAN(in!A2:in!A1471)
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=MODE.SNGL(in!A2:in!A1471)
```

```
=STDEV.P(in!A2:in!A1471)
```

The above formulae we have used to calculate the mean, median, mode and standard deviation of all the relevant numerical columns.

	AGE	DAILY RATE	DISTANCE	EDUCATION	ENVIRONN	HOURLYRA	JOBINVOL	JOBLEVEL	JOBSTATIS	MONTHLY	MONTHI
Mean	36.92381	802.485714	9.192517	2.91292517	2.721769	65.89116	2.729932	2.063946	2.728571	6502.931	14313.
Median	36	802	7	3	3	66	3	2	3	4919	14235.
Mode	35	691	2	3	3	66	3	1	4	2342	915
S.Dev	9.132266	403.371829	8.104107	1.02381653	1.09271	20.32251	0.711319	1.106563	1.102471	4706.355	7115.36

### Insights:

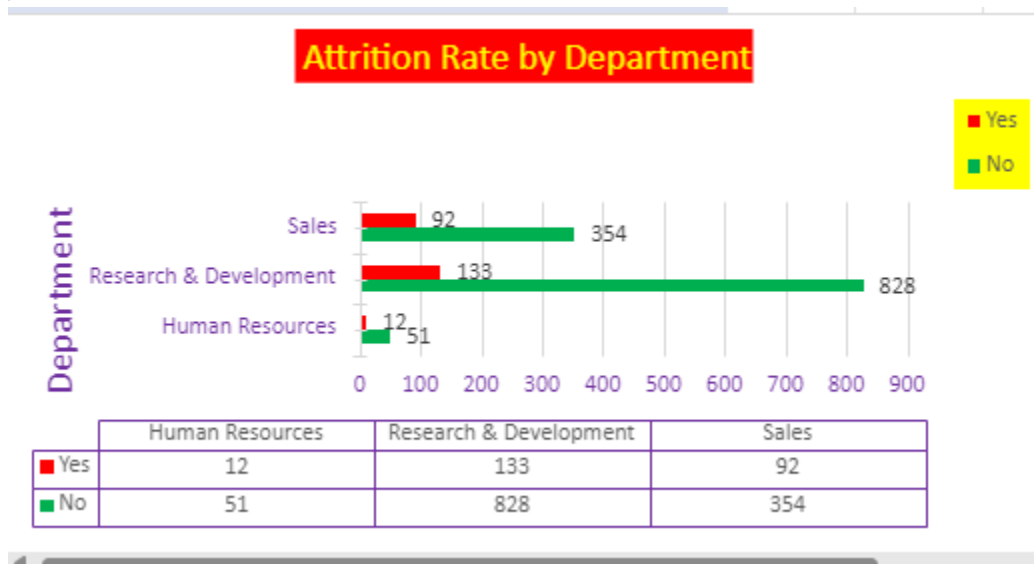
- The average age of the employees working in the company is 36 years with a standard deviation of 9 years.
- The average distance of the employees residence to office is around 9 km with a standard deviation of around 8 km. This means generally all employee are located nearby office with a range of 9-17 km.
- Most of the employees come with educational background of type 3.
- The average environment satisfaction rate is 3 which indicates that it's a neutral satisfaction. Company can work more on the environment to retain the employees.
- Generally employees are on job level 1 with a standard deviation of 1 which indicates most of the employees are either on 1 or 2 job level.
- The job satisfaction level is 4 which indicates that most people are satisfied with the job. But if we look at the mean of satisfaction it drops the rate to around 2.9. So company must work more on the employees whose satisfaction level is 2 or 3 and try to retain them.
- The average monthly salary is approximately Rs 6500 with a standard deviation of Rs 4700. This means there are few people earning approximately Rs 11000 per month.
- Most of the employees have worked in 1 company prior to IBM with a maximum of around 3 companies.
- The average percentage of salary hike is approximately 15% with a standard deviation of around 3% which indicates that maximum salary hike may go upto 18%.

- The average performance rating of the employees is 3 which lies in the middle if the company tries to make its employees more satisfied and give them good culture and motivation then it may lead to the better performance of employees which in turn will help in company's growth.
- The average relationship satisfaction score is also 3. Almost all the scores lie in neutral range which leads to some scope of betterment.
- Stock option level is generally 0. Company can try to involve more employees in their stocks.
- The average total work years is 10 with a standard deviation of approximately 7 years which is a good number which indicates that the employees they have are skilled and gained lots of experience. Company can benefit from their experience and try retaining such employees.
- The average training time last year is 2. Probably we can increase it so as to adapt to new changes effectively and make our current employees more efficient rather than hiring new employees.
- The average work life balance is 3. This also lies in the neutral mode.
- The average years at the company is 5 years with a standard deviation of 6 years. So the employees who complete their 5 years in the company they must be given some bonus or promotion so as to attract them and retain them.
- The average years in current role is around 4 years but when we look at the mode it comes to be 2. This company must handle according to the situation.
- The average years since promotion is approximately 2 years with a standard deviation of 3 years. It indicates that few employees have not been prompted since 5 years and it's such a huge number. Promotion always motivates the employees. Company must keep a check why these employees are not promoted and if they are worth promoting then it should promote them asap.
- The number of years with current manager is almost equal to the number of years in current role which indicates that none of the manager has left the company in all these years.

**DATA VISUALIZATION:** Now we are done with the data analysis part with the help of statistics. The more impactful way of understanding the data is through visualization. We will be addressing few aspects through these charts.

- **Attrition Rate By Department:** First we are going to check for the attrition rate by department, so that we can diagnose if there is any particular issue in any particular department.

Count of Attrition	Attrition <input type="button" value="v"/>			
Department <input type="button" value="v"/>	No	Yes	Grand Total	Attrition Rate
Human Resources	51	12	63	19.04762
Research & Development	828	133	961	13.83975
Sales	354	92	446	20.6278
Grand Total	1233	237	1470	16.12245

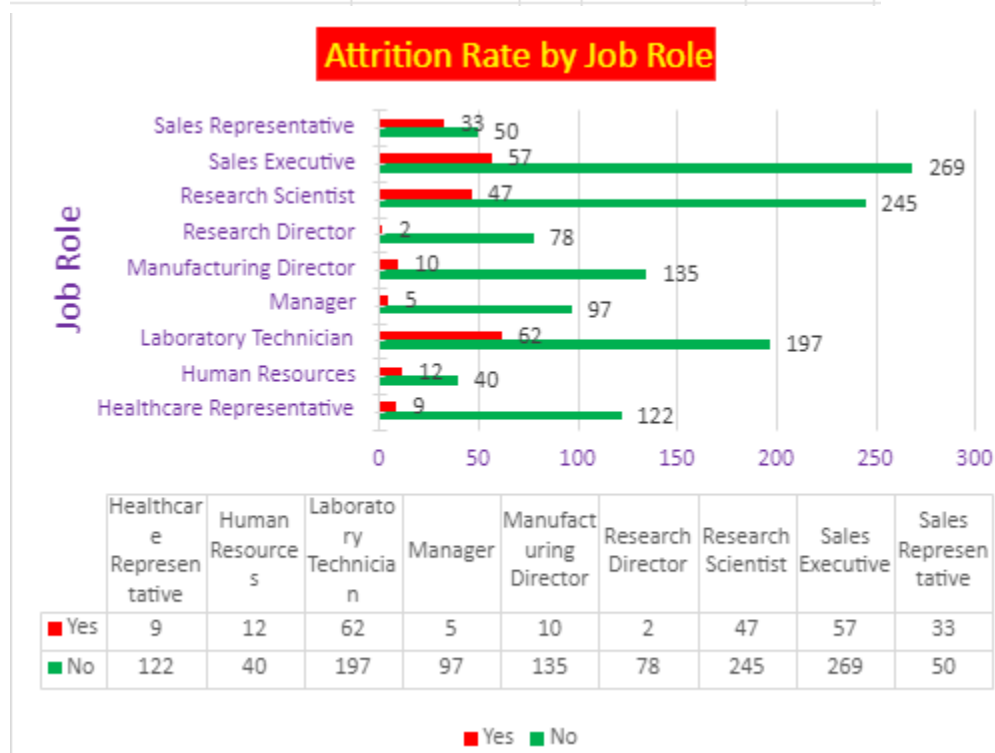


### Insights:

The attrition rates lies between 19-20% and overall its around 16%. The maximum attrition is happening in sales department with around 20%. So company needs to work on its Sales department by giving them more incentives and offers.

- **Attrition Rate by Job Role:** Now we are going to check the attrition rates by job role.

Count of Attrition	Attrition <input type="button" value="v"/>		
JobRole	<input type="button" value="v"/> No	Yes	Grand Total
Healthcare Representative	122	9	131
Human Resources	40	12	52
Laboratory Technician	197	62	259
Manager	97	5	102
Manufacturing Director	135	10	145
Research Director	78	2	80
Research Scientist	245	47	292
Sales Executive	269	57	326
Sales Representative	50	33	83
<b>Grand Total</b>	<b>1233</b>	<b>237</b>	<b>1470</b>

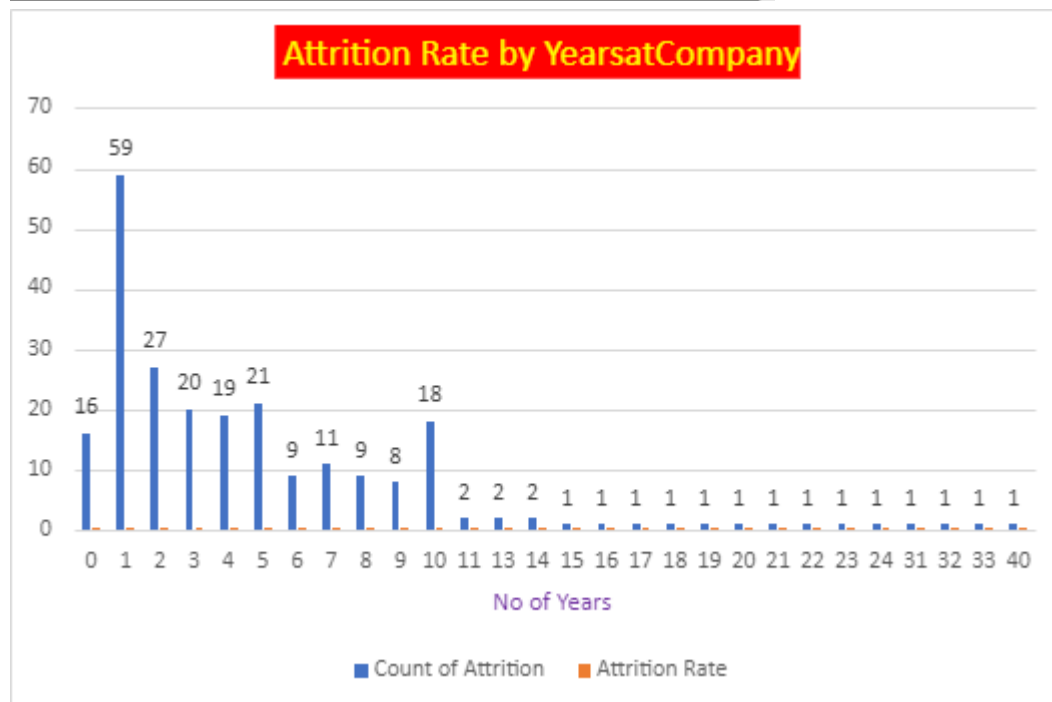


### Insights:

- As we knew that sales department has the highest attrition rate now we dive more into it and find that **Sales Representative** job role has the highest attrition rate of **39%**.
- HR** and **lab technician** roles are the next highest attrition rate role with approximately **23%** attrition in both.
- Company must check with these three job roles majorly to decrease their attrition rate.

- **Attrition Rate by Years at Company:** Now we need to analyze generally after working how many years in the company employees leave.

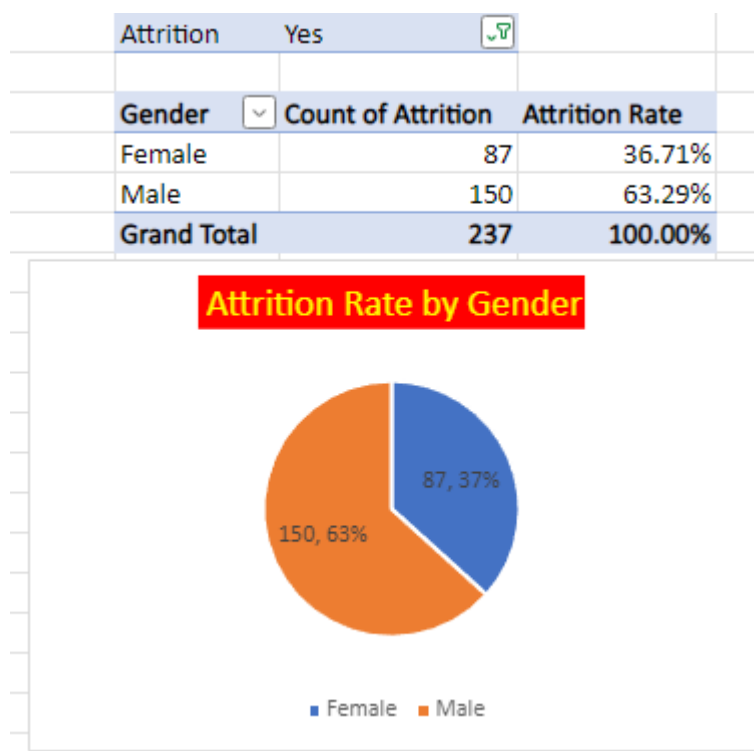
Attrition	Yes	
YearsAtCompany	Count of Attrition	Attrition Rate
0	16	6.75%
1	59	24.89%
2	27	11.39%
3	20	8.44%
4	19	8.02%
5	21	8.86%
6	9	3.80%
7	11	4.64%
8	9	3.80%
9	8	3.38%
10	18	7.59%
11	2	0.84%
13	2	0.84%
14	2	0.84%
15	1	0.42%
16	1	0.42%
17	1	0.42%



**Insights:**



- Generally people leave the company after one year. It has the maximum attrition rate of approximately 25%.
- Second highest attrition rate is for second year with a rate of approximately 11%.
- Company must try retaining their employees after 1 and 2 years by offering bonus or promotion or change of location etc so that they remain in their company.
- **Attrition rate by Gender:** Now we are going to analyze attrition rate by Gender.



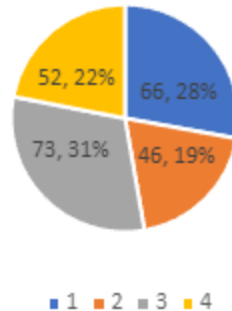
#### Insights:

- Male has the highest attrition rate with 63%.
- Company must follow some practices to retain male employees.

**Attrition Rate by Job Satisfaction:** Now we will have a glance on the attrition rate by job satisfaction.

Attrition	Yes	✓
JobSatisfaction	Count of Attrition	Attrition Rate
1	66	27.85%
2	46	19.41%
3	73	30.80%
4	52	21.94%
Grand Total	237	100.00%

### Attrition Rate by Job satisfaction

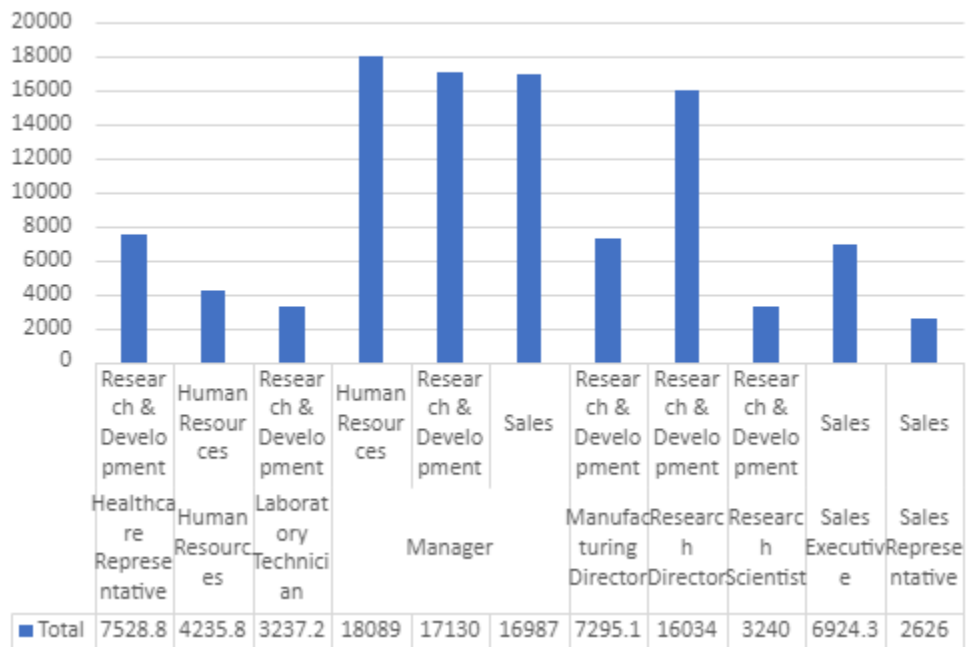


### Insights:

- The highest attrition rate is 31% where the job satisfaction was given as 3. It means there are only few areas to be taken care off because of which satisfaction level is kind of neutral. By taking their feedback and enhancing it's services company can retain most of the employees.
- Second highest rate is for the rating 1 with the percentage of around 28. This should be treated most urgently.
- **Monthly Salary By Job Role and Department:** Now we will have a look on monthly salary by job role and department.

JobRole	Department	Average of MonthlyIncome
Healthcare Representative	Research & Development	7528.763359
Healthcare Representative Total		7528.763359
Human Resources	Human Resources	4235.75
Human Resources Total		4235.75
Laboratory Technician	Research & Development	3237.169884
Laboratory Technician Total		3237.169884
Manager	Human Resources	18088.63636
	Research & Development	17130.33333
	Sales	16986.97297
Manager Total		17181.67647
Manufacturing Director	Research & Development	7295.137931
Manufacturing Director Total		7295.137931
Research Director	Research & Development	16033.55
Research Director Total		16033.55
Research Scientist	Research & Development	3239.972603
Research Scientist Total		3239.972603
Sales Executive	Sales	6924.279141
Sales Executive Total		6924.279141

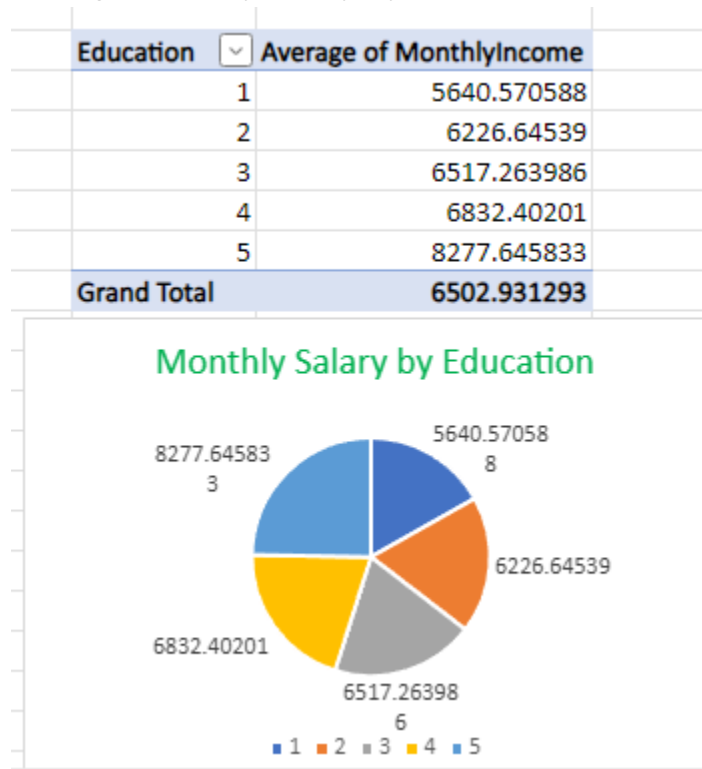
Monthly Income by Department and Job role



### Insights:

- The highest salary is for Managers of departments- HR, R&D and Sales with approximately Rs 17000.

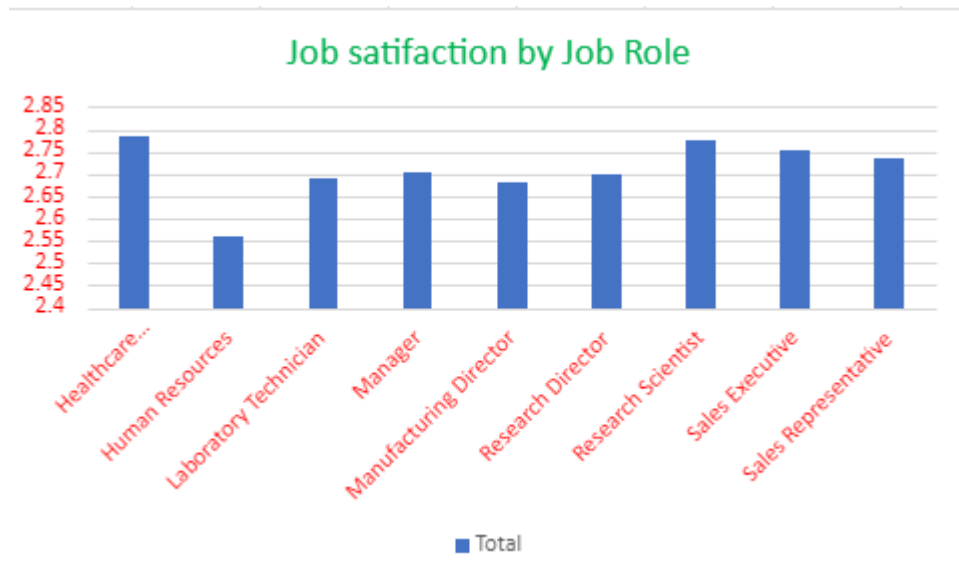
- The lowest salary is for Sales Representative with approximately Rs. 2600 and this could be one of the reason for highest attrition rate in this job role.
- **Average Monthly Salary by Education:** Now are going to analyze the average monthly salary by education level.



### Insights:

- The highest average salary is for education level 5 with Rs 8200 approximately.
- For education level 2,3 and 4 almost get equal salary with some variation.
- They are doing justice with giving maximum salary to highest education level so on this part everyone must be satisfied.
- **Analysis of Job role based on Job satisfaction:** Now we are going to see according to job roles who has given the maximum job satisfaction rating.

JobRole	Average of JobSatisfaction
Healthcare Representative	2.786
Human Resources	2.558
Laboratory Technician	2.691
Manager	2.706
Manufacturing Director	2.683
Research Director	2.700
Research Scientist	2.774
Sales Executive	2.755
Sales Representative	2.735
<b>Grand Total</b>	<b>2.728571429</b>

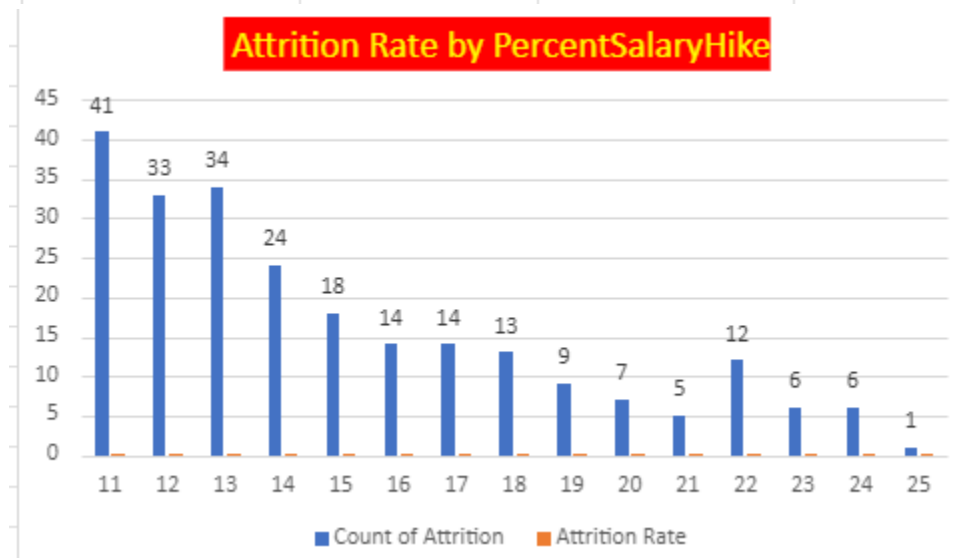


### Insights:

On an average every job role has 2.7 rating. This indicates company needs to take a serious action on maintaining a good satisfaction rate.

**Attrition Rate by PercentHikeSalary:** Now we are going to analyze the attrition rate by percentage of salary hike.

Attrition	Yes	
PercentSalaryHike	Count of Attrition	Attrition Rate
11	41	17.30%
12	33	13.92%
13	34	14.35%
14	24	10.13%
15	18	7.59%
16	14	5.91%
17	14	5.91%
18	13	5.49%
19	9	3.80%
20	7	2.95%
21	5	2.11%
22	12	5.06%
23	6	2.53%
24	6	2.53%
25	1	0.42%
Grand Total	237	100.00%

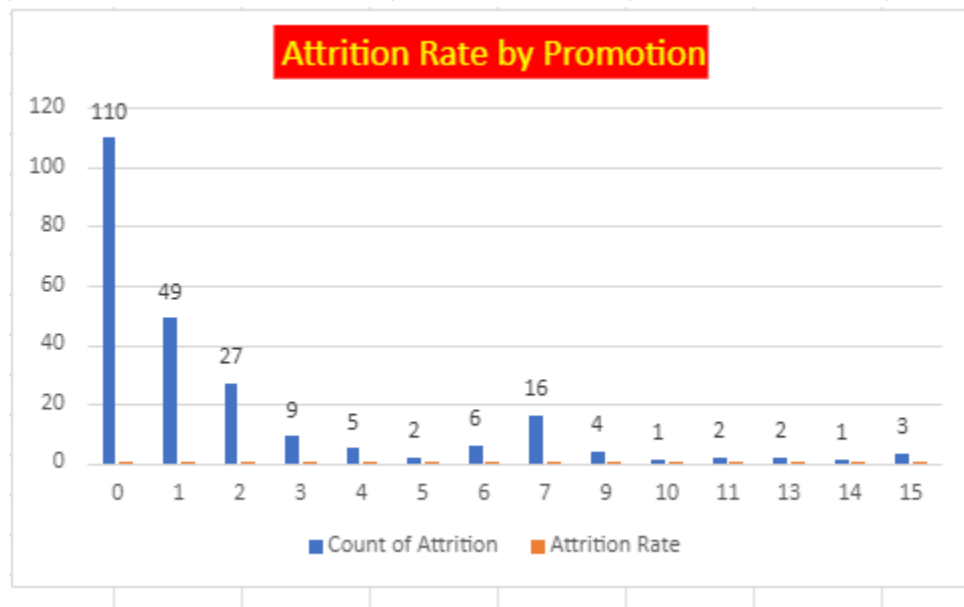


### Insights:

- The maximum attrition rate is for the minimum salary hike they give i.e 11%.
- For the salary hike from 12-14% the attrition rate is high.
- Company must focus on this and give good hike in salary so that employees retain in the company.

- **Attrition Rate by Promotion:** Now we are going to analyze how much impact promotion lays on attrition rate.

Attrition	Yes	
YearsSinceLastPromotion	Count of Attrition	Attrition Rate
0	110	46.41%
1	49	20.68%
2	27	11.39%
3	9	3.80%
4	5	2.11%
5	2	0.84%
6	6	2.53%
7	16	6.75%
9	4	1.69%
10	1	0.42%
11	2	0.84%
13	2	0.84%
14	1	0.42%
15	3	1.27%
Grand Total	237	100.00%

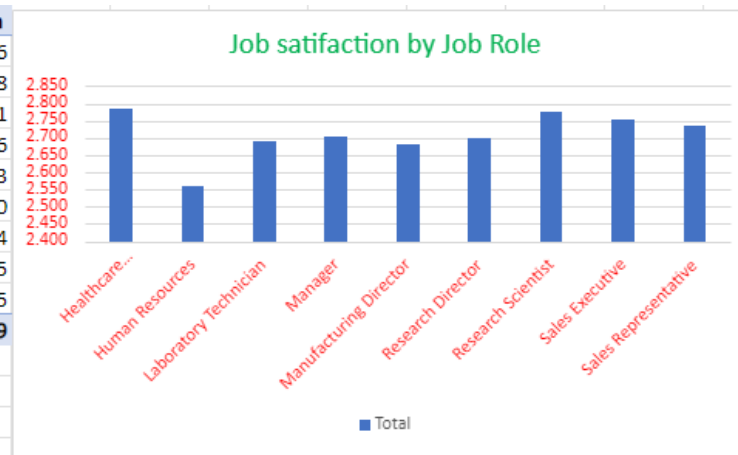


### Insights:

- We can see that attrition rate is highest i.e. approximately 46% where there is no promotion.
- Then where there is no promotion from last 1-2 years and there is a gap of 7 years in promotion the attrition rate is high.

- Company must focus on promoting and motivating its employees as keeping the employees satisfied and retaining them is the key to the success of the company.
- **Job Satisfaction by Job Role:** We will analyze based on the job role how much satisfied the employees are.

JobRole	Average of JobSatisfaction
Healthcare Representative	2.786
Human Resources	2.558
Laboratory Technician	2.691
Manager	2.706
Manufacturing Director	2.683
Research Director	2.700
Research Scientist	2.774
Sales Executive	2.755
Sales Representative	2.735
<b>Grand Total</b>	<b>2.728571429</b>



### Insights:

- On an average all the ratings are revolving around 2.7 with HR (Human Resources) being the lowest with the rating 2.55.
- Overall the company must work upon to satisfy their employees.
- **Impact of number of training years on Performance:** We will analyze the impact of training given to employees on their performance.

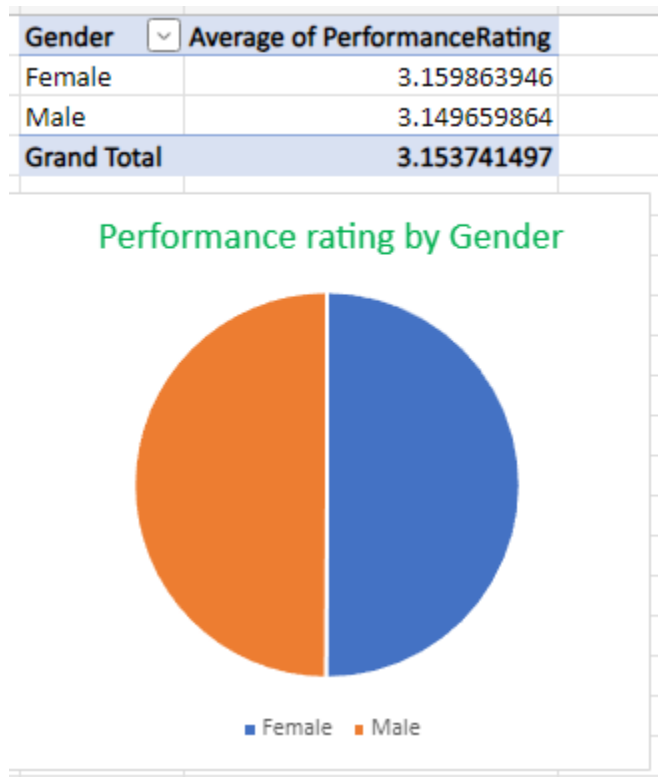
TrainingTimesLastYear	Average of PerformanceRating
0	3.185185185
1	3.126760563
2	3.162705667
3	3.150712831
4	3.130081301
5	3.159663866
6	3.138461538
<b>Grand Total</b>	<b>3.153741497</b>



### Insights:

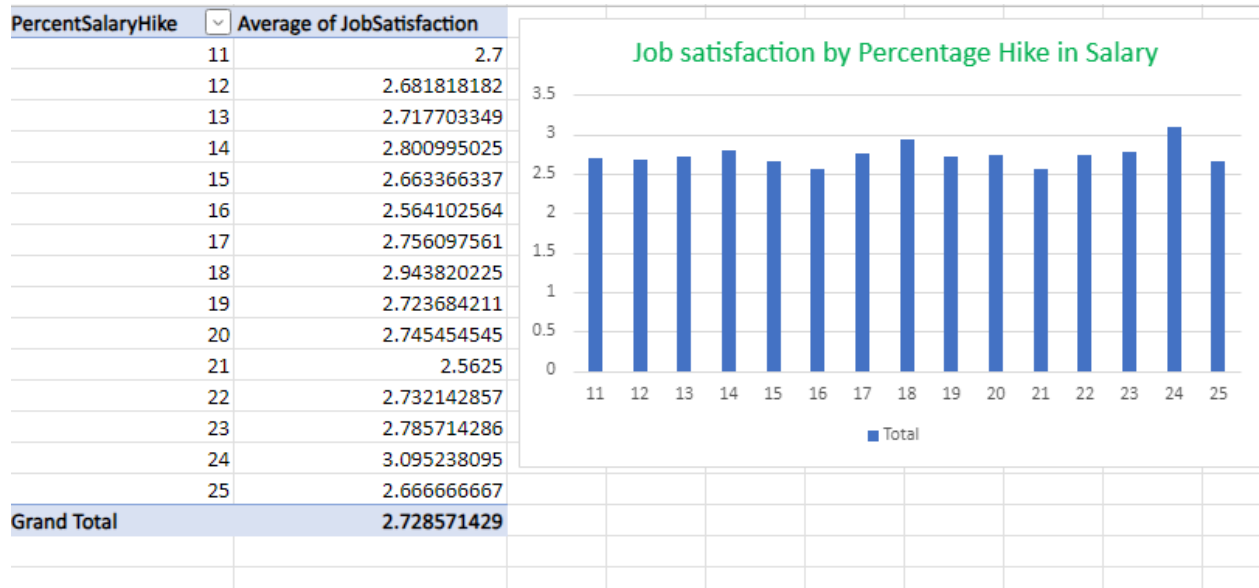


- Despite of getting 0-6 years of training the performance of the employees revolves around 3.15 only.
- Company must try to figure out why the employees are not able to perform upto the mark despite of being given the training.
- **Performance Rating by Gender:** We are going to check the performance based on gender.



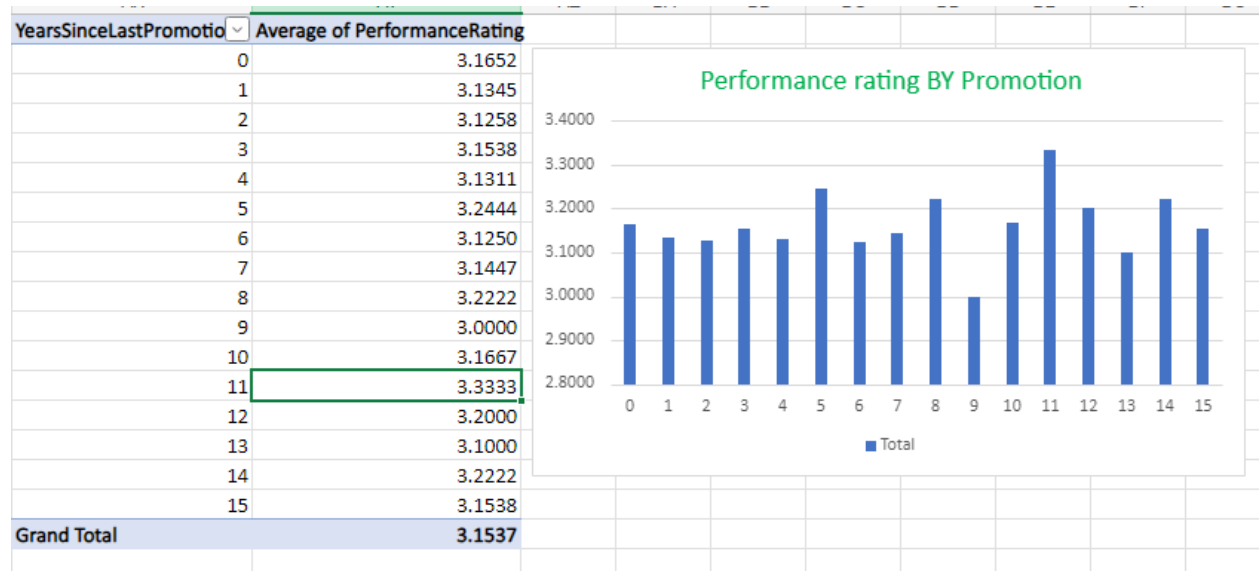
#### Insights:

- Both female and male perform equally with the average rating of around 3.15.
- **Job satisfaction by PercentageHike in Salary:** Let's analyze how percentage hike of salary impacts on the job satisfaction.



### Insights:

- Despite getting varied of salary hike the average job satisfaction revolves around 2.7 only.
- There must be some other factors too despite of the hike in salary due to which the employees are not satisfied.
- **Job Satisfaction by Promotion:** Let's get the glimpse on how the promotion impacts the satisfaction of employees.



### Insights:

- Despite getting promotions at different intervals the average job satisfaction revolves around 3.15 only.

- There must be some other factors too despite of promotion due to which the employees are not satisfied but we can also take in consideration that promotion leads to better satisfaction then salary hike.
- Probably by giving more promotions company can retain more employees.

## **FINAL INSIGHTS:**

### **❖ Demographics and General Statistics:**

- The average age of employees is 36 years, with a standard deviation of 9 years.
- Employees generally live close to the office, with an average distance of 9 km and a standard deviation of 8 km.
- Most employees have an educational background of type 3.
- Environment satisfaction is neutral, with an average rating of 3.
- Employees are mostly on job level 1 or 2, with an average job level of 1 and a standard deviation of 1.
- The average job satisfaction is around 2.9, with most employees rating their job satisfaction at 4.
- Employees have worked in an average of 1 company prior to IBM, with a maximum of 3 companies.
- The average percentage of salary hike is approximately 15%, with a standard deviation of 3%.
- The average performance rating is 3.
- Relationship satisfaction is neutral, with an average score of 3.
- Stock options are generally at level 0.
- Employees have an average of 10 total working years, with a standard deviation of 7 years.
- The average training time last year is 2 sessions.
- Work-life balance is neutral, with an average rating of 3.
- Employees have been with the company for an average of 5 years, with a standard deviation of 6 years.
- The average years in the current role is around 4 years, with a mode of 2 years.
- The average years since the last promotion is 2 years, with a standard deviation of 3 years.
- The number of years with the current manager is almost equal to the number of years in the current role.

### **❖ Attrition Analysis:**

- The overall attrition rate is around 16%, with the highest attrition in the Sales department at approximately 20%.
- The Sales Representative role has the highest attrition rate at 39%, followed by HR and Lab Technician roles at approximately 23%.
- Most employees leave after one year, with an attrition rate of approximately 25%. The second highest attrition rate is for the second year, at around 11%.

- Males have a higher attrition rate at 63%.
- The highest attrition rate is 31% for employees with a job satisfaction rating of 3, followed by a 28% attrition rate for a job satisfaction rating of 1.
- The maximum attrition rate is associated with the minimum salary hike of 11%. Attrition rates are high for salary hikes between 12-14%.
- Attrition rate is highest (approximately 46%) where there is no promotion.
- Attrition is also high where there has been no promotion for the last 1-2 years and where there is a gap of 7 years in promotion.

#### ❖ **Salary and Job Role Analysis:**

- The highest salary is for Managers in HR, R&D, and Sales, with approximately Rs 17,000.
- The lowest salary is for Sales Representatives, at approximately Rs 2,600.
- The highest average salary is for education level 5, at approximately Rs 8,200.
- Employees with education levels 2, 3, and 4 receive almost equal salaries with some variation.
- On average, each job role has a satisfaction rating of 2.7.
- Both female and male employees perform equally, with an average rating of around 3.15.

### **FINAL RECOMMENDATIONS:**

1. **Improve Environment Satisfaction:**
  - Conduct surveys to identify specific areas of dissatisfaction and implement changes to create a more supportive and engaging work environment.
2. **Retention Strategies for High Attrition Roles:**
  - Focus on Sales Representatives, HR, and Lab Technicians to reduce attrition. Implement targeted retention strategies such as competitive salaries, additional training, career development opportunities, and recognition programs.
3. **Retention After 1-2 Years:**
  - Offer bonuses, promotions, or location changes to employees approaching their first and second anniversaries to reduce attrition during these critical periods.
4. **Address Male Employee Attrition:**
  - Investigate reasons for the high attrition rate among male employees and implement retention strategies specifically tailored to their needs.
5. **Improve Job Satisfaction:**
  - Focus on employees with job satisfaction ratings of 1 and 3. Collect feedback to understand their concerns and address them to improve overall satisfaction.
6. **Salary Adjustments:**
  - Review salary structures, especially for Sales Representatives, to ensure they are competitive and fair. Consider increasing salary hikes to reduce attrition associated with lower salary increments.
7. **Promotions:**
  - Increase the frequency of promotions and ensure there is a clear and achievable path for career advancement. This will help in motivating employees and reducing attrition rates related to lack of promotion.
8. **Training Effectiveness:**

- Evaluate the effectiveness of training programs and make necessary improvements to ensure they are contributing to better performance.
- 9. **Performance and Satisfaction Analysis:**
  - Conduct a detailed analysis to identify other factors affecting job satisfaction and performance beyond salary hikes and promotions. Implement strategies to address these factors.
- 10. **Focus on Work-Life Balance:**
  - Promote policies that enhance work-life balance, such as flexible working hours, remote work options, and wellness programs.

By implementing these recommendations, the company can improve employee satisfaction, reduce attrition rates, and ultimately enhance overall performance and productivity.