



A Study On The Role Of Hr Analytics In Predictive Workforce Planning And Decision Making In Manufacturing Industry

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Abstract: This study examines the role of HR analytics in predictive workforce planning and decision-making in manufacturing industry. It focuses on identifying key factors influencing employee retention and the challenges in retaining talent. Using both primary (structured questionnaires) and secondary data, the research analyzes responses from various departments. Statistical tools like percentage analysis and chi-square tests reveal that job satisfaction, compensation, career growth, work-life balance, and management support significantly impact retention. The study ends with suggestions aimed at improving retention strategies and minimizing employee turnover.

Index Terms - HR analytics, Predictive workforce planning, Decision-making, Employee retention, Retention challenges, Compensation, Career growth, Work-life balance.

I INTRODUCTION

HR analytics, also known as people analytics, involves using employee data to support strategic workforce decisions. It plays a vital role in helping organizations plan for future talent needs, streamline hiring processes, retain employees, and increase overall productivity. With tools like predictive modelling, artificial intelligence, and data visualization, HR analytics provides valuable insights into workforce trends. When embedded into key HR areas such as talent acquisition, performance evaluation, and leadership planning, it ensures alignment between human capital strategies and business goals. As digital technologies advance, HR analytics is set to become even more integral to effective workforce management and planning.

II OBJECTIVES OF THE STUDY

- To analyse the role of HR analytics in Predictive Workforce Planning.
- To analyse the role of HR Analytics in Decision Making.
- To provide strategic recommendations for business to leverage HR analytics effectively.
- To identify barriers and challenges in implementing HR analytics for predictive workforce planning.

III SCOPE OF THE STUDY

- HR analytics leverages artificial intelligence and data trends to predict future staffing needs.
- It helps reduce turnover by detecting potential reasons for employee exits.
- Assists in spotting skill shortages and planning for future leadership roles.
- Improves the efficiency of the recruitment process and boosts employee retention.
- Reliable insights depend on using smart tools and up-to-date data.

IV REVIEW OF LITERATURE

1. **Shikhar (2020)** HR analytics supports strategic workforce planning during mergers and acquisitions by analysing historical data to accurately forecast talent needs, ensuring smoother organizational transitions.
2. **IEEE Conference Publication (2023)** HR analytics helps businesses make data-driven decisions in talent acquisition, retention, and development, while also highlighting potential ethical and legal concerns.

V RESEARCH METHODOLOGY

The methodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample of the study, Data and Sources of Data, study's variables and analytical framework. The details are as follows;

3.1 Population and Sample

The total population consisted of all employees working in different departments. Total population is 176. Sample size determination is the act of choosing the number of observations or replicates to include in a statistical sample. The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample. The sampling size of this study is 110, which is determined by Krejcie and Morgan Table.

3.2 Data and Sources of Data

Both primary and secondary data was used for the research

Primary data

Primary data is directly collected from the respondents in the field of study

Secondary data

Secondary data was used with the help of information taken from journals, articles, internet and existing research.

3.3 Statistical tools and econometric models

The collected data were analyzed with reference to each of the specific objectives of the study and the following statistical techniques were used in the study.

The collected data has been analyzed by the following statistical tool:

1. Percentage
2. Chart
3. Mann-Whitney U Test
4. Kruskal Wallis H Test
5. Chi-square test

1. Percentage analysis

It refers to a special kind of ratio. This is used for making comparison between 2 or more series of at it is denoted by %. %-(Number of respondents / total respondents) 100 percentages measures of central tendency. Percentages are often used in the data presentation, the data are reduced in the standard form with base equal to 100, which facilitate relative comparison.

$$\text{Percentage} = \frac{\text{Number of respondents}}{\text{Total respondents}} * 100$$

2. Chart

A chart in research is a visual tool used to represent data clearly and concisely. It helps identify patterns, trends, and relationships, making complex information easier to understand. Common types include bar charts, pie charts, and line charts, which are often used to support analysis and enhance the presentation of research findings.

3. Mann-Whitney U test

The Mann-Whitney U test, also known as the Wilcoxon rank-sum test, is a non-parametric statistical test used to determine whether there is a significant difference between two independent groups when the data is not normally distributed or when the assumptions of parametric tests are not met. It's often used when you have two groups and you want to compare their distributions or central tendencies.

The Formula for calculating the Mann-Whitney U test statistic U is:

$$U = \min(U_1, U_2)$$

Where :

- U1 is the sum of ranks for one of the groups.
- U2 is the sum of ranks for the other group.

4. Kruskal-Wallis H test

The Kruskal-Wallis H test, also known simply as the Kruskal-Wallis test, is a non-parametric statistical test used to determine whether there are statistically significant differences among the medians of three or more independent groups. It is used when the assumptions of normality and homogeneity of variances, which are required for parametric tests like ANOVA, are not met.

The formula for calculating the Kruskal-Wallis H statistic:

$$H = \frac{12}{N(N+1)} \sum_{i=1}^k \frac{R_i}{n_i} - 3(N+1)$$

Where :

- H is the Kruskal-Wallis H statistic.
- N is the total number of observations across all groups.
- \sum denotes the sum over all groups
- R_i is the sum of the ranks for group i.
- n_i is the number of observations in group i.

5. Chi square test

The chi-square test is a statistical method used to determine if there is a significant association between categorical variables. It compares the observed frequencies in a dataset with the expected frequencies to see if differences are due to chance. This test is commonly used in research to analyze survey results, contingency tables, and independence between variables. A higher chi-square value indicates a greater difference between observed and expected data, helping researchers assess relationships. It is widely applied in fields like business, healthcare, and social sciences for data-driven decision-making.

The formula for the Chi-Square (χ^2) test is:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where :

- χ^2 = Chi-Square statistic
- O = Observed frequency
- E = Expected frequency
- \sum = Summation across all categories

This formula calculates the difference between observed and expected values to determine if the variation is statistically significant.

3.4. Descriptive Statistics

Descriptive statistics refers to the branch of statistics that focuses on summarizing and organizing data in a meaningful way. It involves the use of numerical and graphical techniques to present the essential characteristics of a dataset.

These techniques include measures of central tendency (mean, median, mode), measures of variability or dispersion (range, variance, standard deviation), and measures of distribution shape (skewness and kurtosis). Descriptive statistics do not allow for conclusions beyond the data analyzed, but they provide a foundational understanding that facilitates further statistical analysis.

In research, descriptive statistics are crucial for presenting initial insights into the data, allowing researchers to identify patterns, trends, and potential anomalies before conducting inferential statistical procedures.

VI. DATA ANALYSIS AND INTERPRETATION

Table showing Respondents' Demographic Details

Categories	Sub Categories	No. of Respondents	Percentage
Age	Below 25	51	46
	25 - 50	46	42
	Above 50	13	12
Gender	Female	66	60
	Male	44	40
Experience	Below 3 years	41	36
	3 - 5 years	42	37
	Above 5 years	27	27
Income	Below 40,000	39	35
	40,000 - 60,000	52	47
	Above 60,000	19	17

FINDINGS :

The respondents' age distribution is: Below 25 years – 46.36%, 25–50 years – 42.20%, and Above 50 years – 11.93%

Female respondents: 60%, Male respondents: 40%.

Experience-wise: Below 3 years – 36.0%, 3–5 years – 37.0%, Above 5 years – 27.7%.

Monthly income: ₹40,000–₹50,000 – 47.3%, Below ₹40,000 – 35.5%, Above ₹50,000 – 17.3%

INFERENCE :

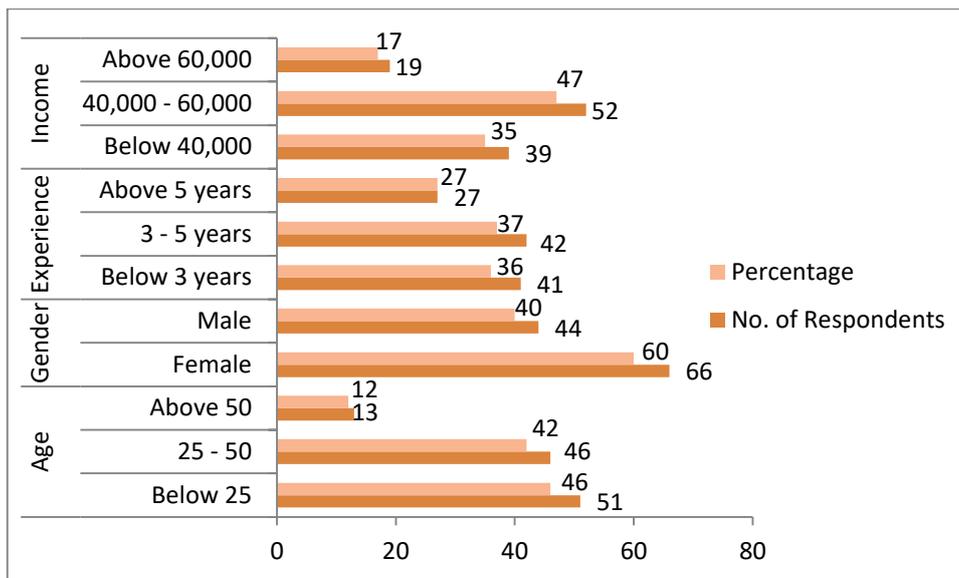
It is inferred that 46.36% of the respondents are below 25 years of age.

It is inferred that 60% of the total respondents are female.

It is inferred that 37.0% of respondents have 3–5 years of experience, indicating a balanced workforce.

It is inferred that ₹40,000–₹50,000 is the most common income range among respondents.

Chart showing Respondents' Demographic Details



**STATISTICAL TOOLS
MANN WHITNEY – U TEST**

H₀ (Null Hypothesis): There is no significant difference in HR Predictive scores between male and female respondents.

H₁ (Alternative Hypothesis): There is a significant difference in HR Predictive scores between male and female respondents.

TABLE SHOWING THE GENDER-BASED HR SCORE COMPARISON

Test Statistics	
	AFFECTIVE
Mann-Whitney U	1248.500
Wilcoxon W	3459.500
Z	-1.365
Asymp. Sig. (2-tailed)	.172
Grouping Variable: Gender	

INFERENCE:

The Mann–Whitney U test showed a P value greater than 0.05 for the variable “HR Predictive Score,” indicating no significant difference between male and female respondents. Thus, gender does not influence perceptions of HR predictive analytics, and the null hypothesis is accepted.

KRUSKAL WALLIS H TEST

H₀: There is no significant difference in analytics performance perceptions across age groups.

H₁: At least one age group differs significantly in their perception of analytics performance.

TABLE SHOWING THE ANALYTICS PERFORMANCE BY AGE GROUP

Test Statistics	
	ANALYTICS_PERFORMANCES
Kruskal-Wallis H	3.424
df	2
Asymp. Sig.	.181
a. Kruskal Wallis Test	
b. Grouping Variable: AGE	

INFERENCE:

The Kruskal–Wallis H test showed a P value above 0.05 for “Analytics Performance” across age groups, indicating no significant difference. Thus, age does not affect perceptions of analytics performance, and the null hypothesis is accepted.

CHI-SQUARE / FISHER’S EXACT TEST – INFERENCE

H₀: There is no association between gender and awareness of HR analytics.

H₁: There is an association between gender and awareness of HR analytics.

TABLE SHOWING GENDER-BASED AWARENESS OF HR ANALYTICS

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.403 ^a	1	.236		
Continuity Correction	.838	1	.360		
Likelihood Ratio	1.377	1	.241		
Fisher's Exact Test				.286	.180
Linear-by-Linear Association	1.390	1	.238		
N of Valid Cases	110				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.80.					
b. Computed only for a 2x2 table					

INFERENCES :

The Chi-Square and Fisher's Exact Tests showed P values > 0.05 , indicating no significant link between gender and awareness of HR analytics. Thus, awareness is independent of gender, and the null hypothesis is accepted.

VII SUMMARY OF FINDINGS

1. 46.36% of respondents are under 25, representing the majority age group.
2. 60% of respondents are female, making women the majority.
3. 37.0% of respondents have 3 to 5 years of experience in the company, indicating a relatively balanced workforce with a mix of fresh and experienced employees.
4. The majority of respondents earn between ₹40,000 and ₹50,000, the most common salary bracket.
5. The Mann–Whitney U test showed no significant gender difference in "HR Predictive Score," confirming the null hypothesis.
6. The Kruskal–Wallis H test found no significant difference in "Analytics Performance" across age groups ($P > 0.05$), so age does not impact perceptions of analytics performance, and the null hypothesis is accepted.
7. The Chi-Square and Fisher's Exact Tests ($P > 0.05$) showed no significant link between gender and HR analytics awareness, confirming the null hypothesis.

VIII SUGGESTION

1. Organize regular team-building events to foster better collaboration and increase productivity.
2. Strengthen internal communication through frequent updates, engaging meetings, and effective feedback systems.
3. Prioritize leadership training programs for younger employees to improve retention and career growth.
4. Broaden the application of HR analytics to cover more areas, including succession planning and workforce productivity.
5. Enhance HR analytics infrastructure and offer continuous training to overcome technical challenges and ensure smooth adoption.

IX CONCLUSION

This study explored the factors that influence employee engagement and its impact on organizational performance. The results indicate that employees generally find their work environment supportive, with positive views on recognition, communication, and career development opportunities. Tests such as Mann–Whitney U, Kruskal–Wallis H, and Fisher's Exact Test showed that demographic factors like gender, experience, and education had little effect on engagement perceptions. However,

differences based on educational background suggest that engagement strategies could be more tailored. While the organization's engagement efforts are largely effective, there is room for improvement in areas like communication, recognition, and personalized strategies to enhance employee satisfaction and productivity.

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