

# Application of Predictive Analytics in Strategic Workforce Planning

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**Abstract** - Facing drastic technology transformations, human resource in organizations today focuses on evidence-based decision making. It is imminent that data is integral with decisions for human resource practitioners while managing a diverse workforce. Organizations can no longer be reactive with digitalization possibilities to gain a competitive advantage over global workforce challenges. High performing organizations scheme on resolving talent issues through proper workforce planning strategically aligned towards the relevant business context. E-HRM based organizations with huge data are yet to realize the potential of predictive workforce analytics. This article intends to provide insights on the predictive power of analytics aligned to talent planning strategy and application of predictive analytics for below:

- a. Talent Forecasting
- b. Effective Recruitment decisions
- c. Skill gap analysis and Succession planning
- d. Performance Finetuning and employee retention targeting
- e. Turnover risk monitoring
- f. Training effectiveness

which can influence the potential business outcome with limits of predictive models. Also, we conclude that strategic workforce analytics is still evolving and shaping the future of the workforce.

**Index Terms** - Predictive Analytics, Strategic Workforce Planning, E-HRM

## I. INTRODUCTION

Global Human Resource (HR) digitalization and new technologies have leveraged HR experts to be more effective and productive. With vast opportunities, digitalization brings new scope to management perspectives requiring more competence from the Organization level. Change occurs in every level which goes through several change resistance and adaptations. This points out the necessity of Electronic Human Resource management(E-HRM) in organizations to be effective in a competitive market. Strohmeier (2007) [1] describes E-HRM is the planning, implementation, and application of IT for both networking and supporting at least two individual or collective actors in their shared performing of Human Resource (HR) activities. These technology services play a significant “Anytime, anywhere” access and thereby reducing cost and time and increasing transparency and standardized HR process. This Technological infrastructure gives insights on the everyday talent challenges and ensures strategic delivery towards talent goals.

David Ulrich (2009) [2] quotes “Talent management is the systematic process of creating and sustaining individual competencies that will help the business deliver strategy”.

AIHR describes ‘Talent management is the full scope of HR processes to attract, develop, motivate and retain high-performing employee’. For effective Talent Management and high performing workforce, driving success, HR Strategy must be aligned with the business strategy by Workforce Planning.

## II. STRATEGIC WORKFORCE PLANNING

Strategic Workforce planning is a proactive approach to ensuring "Right People at the right time for the right place at the right cost". CIPD (2019) [3] describes “Workforce planning is the process of analyzing workforce, determining future workforce needs, identifying gaps within, implementing solutions that the Organizations can accomplish its mission, goals and strategic plan”. This helps the HR leaders in planning capabilities needed in the future, solve staffing problems and helps in ideal decision making while facing workforce challenges in the global market under volatile economic conditions. Strategic Workforce planning is the same as workforce planning but ensures the Talent goals in alignment with the business strategy.

Strategic workforce planning is:

1. Analyzing the quality and quantity of the workforce:  
Skill mapping, performance analysis, accessing the potential of the workforce and the number of employees on hiring, internal movement, and retirement.
2. Anticipating future needs:  
Anticipate workforce challenges and needs.
3. Analyze the future workforce:  
Leveraging the scenario planning with digital HRM tools and create advance action plans.

This is essential in taking the step ahead in aligning the future workforce with the desired workforce. Scenario-based workforce planning takes a combination of skills and roles in the broader business context. Organizations tend to evolve their approach to the resourcing problems by using the huge data on the employees in Human Resource Information Systems.

**III. HUMAN RESOURCE ANALYTICS**

Data emerges in and out of the Organization. Every data has value and this data is the input for HR Analytics, which is the practice of deriving insights from data to make better fact-based decisions, explore the sophisticated analytic capabilities and reap potential benefits. This is used in making decisions on customer strategy, operational issues, workforce strategy and optimize decisions. With the Global talent challenges hunting the organizations, the magic of analytics visualizes organizational analytic capabilities based on requirements. Based on the capabilities, HR analytics gives way for traditional data sources, with operational data along with the nontraditional data to derive at the insights that create business value.

Different type of analytics:

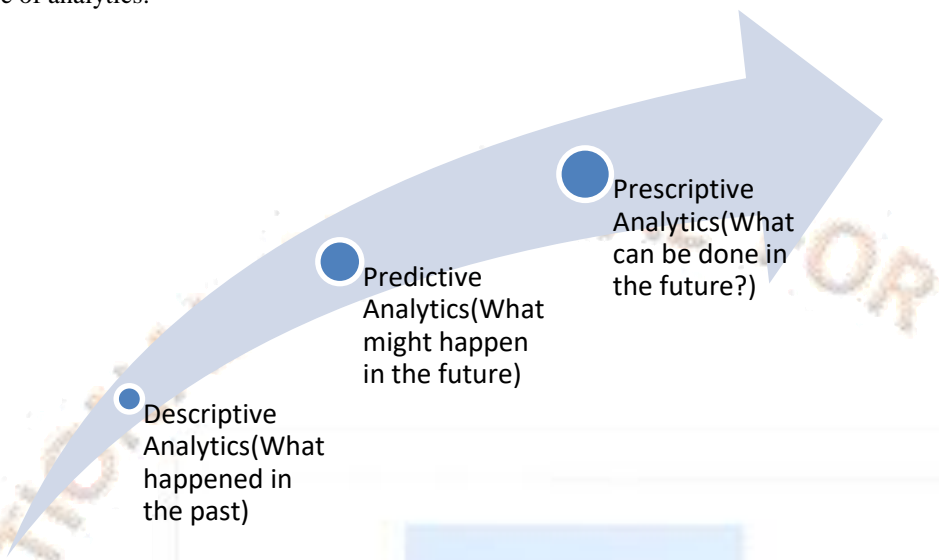


Figure 1: Types of Analytics

Descriptive analytics is reactive and predictive analytics is proactive. Being proactive keeps the organizations ahead in the unpredictable market.

**IV. PREDICTIVE ANALYTICS**

“Nobody Questions the importance of knowing what happened outside, but such knowledge should be preceded by knowing what happens inside. Appropriate balance between looking outside and knowing the inside seems to be an obvious solution to this crisis”- Jac Enz Fitz (2010) [4]

Power of Analytics supported by data-driven people's actions with insights gives predictive capability. Predictive analytics is the technology that uses data to predict future behavior to drive better decisions. Data-driven decision making relies on empirical evidence. Companies have started making own predictive models based on machine learning to unleash full capabilities of predictive models. Human resource predictive analytics can be used for predicting unforeseen talent challenges, decision making prediction and impact analysis which can save millions for the Organizations. Predictive Analytics uses historical data to build the predictive model and the new data is fed into the model to get the prediction.

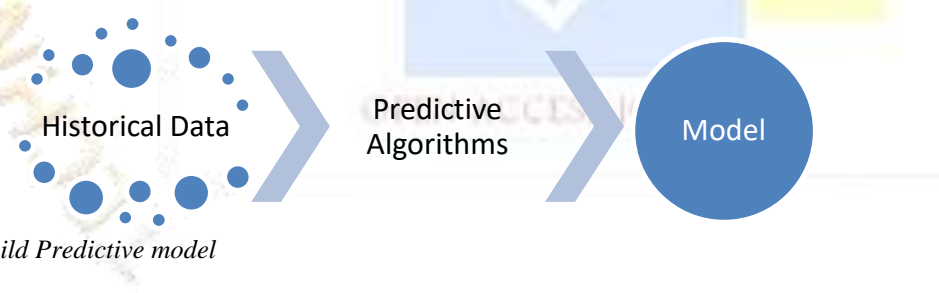


Figure 2: Build Predictive model

These deployed models with predictive capability skills and visualization tools which is required for getting good answers to what will happen among the employees. So that the focus is on the right population to get better outcomes.

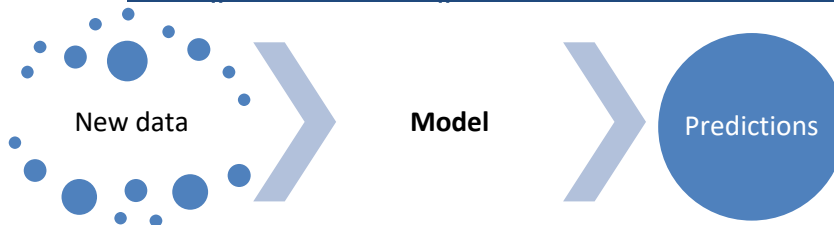


Figure 3: Predict with Model

For every situation requiring prediction, the first step is to identify what the predictive question is. What needs to be predicted is what is required. Predictive analytics data should be of good quality and requires proper Data Collection and benchmarking. A better understanding of skills and experiences increases the probability of choosing the right people in the right position at the right time.

Below are a few everyday workforce challenges, where predictive HR Analytics can be applied

### A. Talent Forecasting

Talent forecasting is the pillar of talent acquisition. Talented employees drive the Organization towards their goals. The talent management process involves time series forecasting with discovered knowledge based on the list of potential talents and opportunities identified. Continuity in performance is ensured in business when the pattern of behavior changes with proactive forecasting of talent needs. Enough resources should be available to ensure productivity in every line of business for enabling organizational success. Integrated with HR Analytics, when talent pattern keeps changing and knowledge of top management on the expected future workload and employee efficiency is important. HR experts do it better on experience with huge data on time series extrapolation and different techniques on decision tree family, which are easy to interpret.

Talent forecasting helps in ensuring the right people and the right number of people. Without proper tools and models that can be ineffective. Better management of talent needs is crucial, but the right tool needs to be implemented where Organizations thrive on Global Talent, being proactive in predicting future requirements. With business plans identifying the key players and positions that are going to drive the change in the long-term gives an edge over the competitors and forecasting with connecting data with forecasting capability on the challenges and the Talent opportunities. Talent forecasting is about understanding business and technology to find out a way to deliver an effective workforce that enables quick hiring and less time wasted over it. Various algorithms can be used but the XGBoost algorithm which the latest addition to the time-series forecasting is more influential.

The objective of the XGBoost model is given as:

$$\text{Obj} = L + \Omega$$

Where,  
L is the loss function which controls the predictive power, and  $\Omega$  is a regularization component which controls simplicity and overfitting.

The regularization component ( $\Omega$ ) is dependent on the number of leaves and the prediction score assigned to the leaves in the tree ensemble model.

Both regression and classification predictive modeling problems are supported by the Gradient boosting algorithm. Competing workforce changes make linear predictions more complex and the human-centric approach becomes necessary with too many external factors affecting the labour market.

### B. Effective Recruitment Decisions

Wikipedia states Recruitment as a process of attracting, selecting and deploying the desirable candidate for jobs within an organization. Putting a lot of costs on the new hiring process, the decision needs to be correct that the Organization does not suffer for the wrong choice. “Should the person be Hired?” is the definitive question that needs prediction based on the previous trends. This result should support the original decision of the recruiter. This Recruitment analytics can help in identifying the High potential candidates who will be the perfect fit for the job role without any bias in the process.

Various factors like years of experience, working period with previous employers, level of education, salary trend and skillsets are used, and the Decision Tree algorithm is used to help decide whether the candidate should be hired or not. Profile matching algorithms can also be used in comparing the standard profile requirements with the candidate profile.

This is a rather simple method by Nitisha (2015) <sup>[5]</sup> which used the formula  
 $X_{pa}$  – Score of person p on skill a  
 $X_{sa}$  = Score of standard profile person s on skill a  
 then  $D2 = (X_{pa} - X_{sa})^2$   
 and  $\Sigma D2$  would represent the degree to which the profile of person p matched the standard profile. The larger  $\Sigma D2$ , the poorer the match.

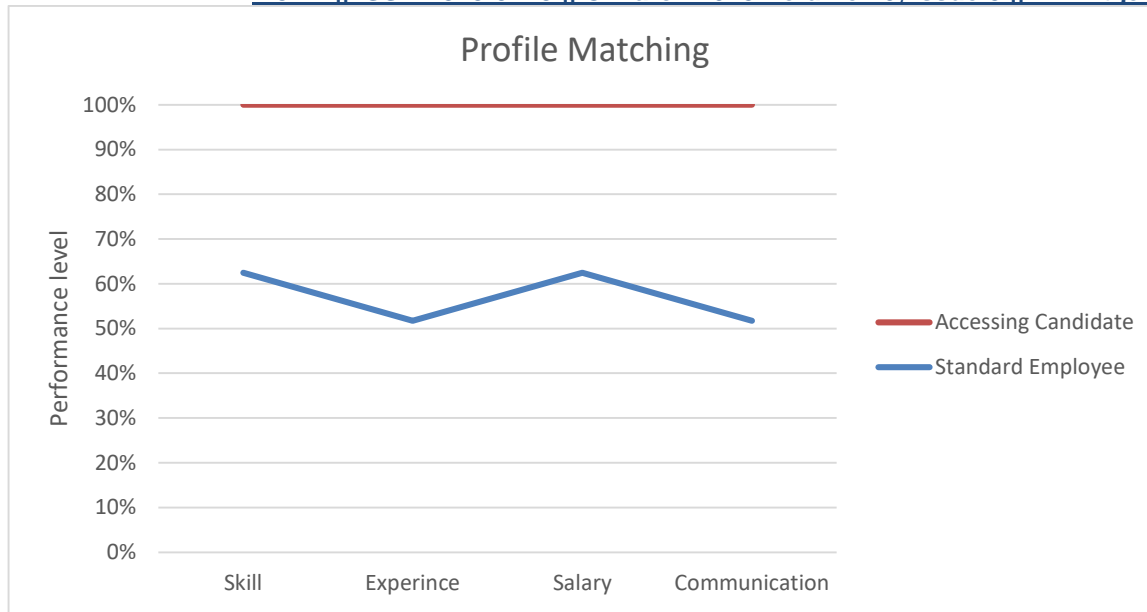


Figure 4: Profile matching

These can accelerate time to hire finding the best fit and improve the decision-making process seamlessly.

### C. Training Effectiveness

The importance of Training evaluation in HR is not getting the importance deserved. Organizations have a bias in undermining training evaluations which seems to be a persistent problem. Organizations need to analyze the effectiveness and impact of training which should contribute to the individual and as well as the organizations. The acquired knowledge should apply to organizational growth thereby improve their learning. Training sessions are valuable but often employees tend to ignore. Measuring the effectiveness of training and the reaction and action after the training is important which when becomes ineffective will be a considerable ROI loss to the organization. So, the trainees’ feedback and the progress and the skill development after the training should be measured and the data should help the organization to identify the effectiveness.

Some of the data will be helpful for analyses is obtaining the reaction immediately after the training.

1. Pre-training assessment
2. Post-training assessment
3. Presentation and training style
4. Is the training engaging?
5. How do they think it can be applied in the job role?
6. Pros and cons of training
7. Was it a success?

Some training on behavioral and communications have a serious impact on this globalized clientele. The employees with direct client-facing should have developed the skill, attitude and the gaining confidence to communicate in their job roles. After the training, even it’s a long-term process, measurements should be done on the skills of the employees. And whether they were able to apply the gaining knowledge. Then the results of the training sessions are analyzed. Kirkpatrick Model is appropriate to many situations which describe the effectiveness of training falls under four levels.:

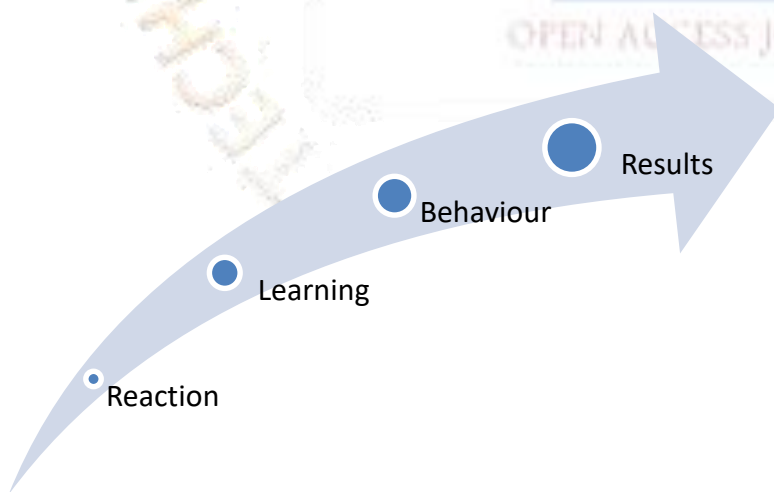


Figure 5: Kirkpatrick Model of Training Evaluation

Skills data on the employees are the base for Analytics usage towards training effectiveness.

Data application should be analyzed on the correlation of position of employees, Skills, Training courses attended, positive reaction to training, latest added skill, job satisfaction level after training, performance after training. Those data should be compared with the employees who have not attended the training and These data should be modeled to decide on whether the training was a success. The decision tree model can be used for arriving at a decision on whether the training improved job satisfaction and performance. And this will help on supporting to continue or discontinue the training program.

Effective training opportunities can even improve retention, positive employee attitudes, improved employee satisfaction, and client satisfaction.

#### D. Turnover Risk Monitoring

Employee turnover is the most universal HR problem today. Whether it is voluntary or involuntary, turnover costs the organization high, especially when a high performing employee leaves the organization. It is not only the financial spending on acquiring a new employee, but it also disturbs the other employees when the critical resource moves out. When it is involuntary, that creates disturbances within the employees about their job security that affects the overall performance of the Organization.

$$\text{Turnover Rate} = \frac{\text{Employees learning during the period}}{\text{Average Number of Employees during the period}}$$

Before the picture of analytics, Turnover was just an annual metric for every organization. But now every Organization is keen on predicting and monitoring the risks of Turnover. This is done by analyzing the turnover data which should involve who is resigning from the organization:

1. High Performers
2. Niche skilled
3. Seniors
4. Department

Then the employee data is extrapolated and the k-means clustering algorithm can be applied to the data and factors that influence the turnover can be highlighted. Correlation studies are applied with the various factors that drive employees to resign and model applied to identify who are the high-risk employees. These predictive models can identify which of the potential employees are at the risk of leaving the Organization.

#### E. Performance Finetuning and Employee Retention Targeting

Recruiting Best talent is the biggest challenge today. On obtaining the best resources, do the Organizations get the best out of them is the real question? Employee job satisfaction is directly associated with Job Performance. When the employee is satisfied, that increases their quality and quantity of their work. With the e-HRM systems on hand, accessing performance measurement and employee attitude and feedback is no longer a tussle. A lot of metrics data is available for accessing performance which are tangible goals, performance scores, product quality, feedbacks, employee ranking, resolution time, absenteeism, ROI, revenue per employee.

This strategy is closely related to the turnover reduction which is also termed as retention targeting. On assessing the resignation and turnover rates, proactive actions need to be taken by reducing the risk of losing a high potential employee. Every employee is different and the analytics on accessing the employees at the risk of leaving are targeted for retention. Scenarios like Senior employees may not like the routine jobs, Employees with niche skills are more on-demand and they expect a salary hike as par with the labor market, some employees need to engage are influencing factors (Lieberman,2018) [6].

Historical data with the proportion of employees leaving after predicting, the trend analysis needs to be done on what employees need, based on their behavior pattern and the retention strategy must be planned accordingly.

By reducing voluntary turnover, Organizations have the savings that include retirement, productivity loss, recruiting costs that ensure the workforce alignment towards business by adapting suitable strategy.

#### F. Skill Gap Analysis and Succession Planning

Skill gap analysis is the measurement of the difference between the current skillset and required skillset. This can be foreseen by assessing the skills required for future goals and strategy can be implemented in identifying the same. This helps in identifying weak positions to meet the future requirements which are done on individual and team levels. Organizations have difficulty in filling incompetent jobs. Below is the basic process of

1. Identify niche skills
2. Measure skills
3. Identify skill gaps
4. Train or hire

With the skill gap analysis, Organizations get the opportunity to understand the skills needed and optimize the planning of organizational strategy towards talent challenges and get the Workforce ready for the future. Reskilling employees and hiring and cross-skilling potential employees in the diverse talent pool to build the talent pipeline. Losing a potential candidate can be bad for organizations that are not only time consuming but result in less productivity, competency and cost on replacing with a knowledgeable employee.

Successors can be found internally in the Organizations with a diverse workforce as they are already familiar with the Organizational systems and change of role would make a considerably smaller effect by bridging the skill gap.

Data related to project experiences, designations, performance appraisals, previous career roles, and others can all be used to derive insights about possible successors for a leaving employee. A good successor planning system should be able to find employees who are the closest possible fit for a leaving employee while also ensuring that the successor can be a strong and productive contributor in his new role.

Succession metrics factors like depth (average candidates in the pipeline), utilization (average internal filled positions), turnover (succession candidates who left the company), availability (succession candidates' availability to join), external hiring rate need to be used for planning successions. Upon metrics selection, HRIS data is analyzed with the Algorithms. Previous studies (Gowtham Mainkar, 2017)<sup>[8]</sup>, have used the Vector Distance algorithm which uses the relevant employee attributes and the distance between the vectors is calculated. This algorithm needs data as numeric like the employee information to be in numbers like:

<b>Numerical Classification</b>	Total experience, Experience in the same organization, salary Skills, position, department
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Data should be transformed in numbers as needed by using a relationship matrix. The distance between the variables is calculated and the candidate with the least vector distance is identified as potential successors. The threshold distance may vary with the skillsets and then the list of candidates with the threshold distance is ranked based on the evaluation. This prediction can save time and cost for the Organization to scan and identify potential successors.

## V. CONCLUSIONS

It is a major trend, yet the misrepresentation of the execution stalls the organizations' success. The successful application of analytics creates a positive impact by solving the talent issues and reducing the costs of risk. Growth of predictive analytics is inevitable, and organizations engaged in strategic workforce planning should adapt the change to solve the talent challenges through predictive HR analytics.

In this paper, the importance of predictive HR Analytics as a tool of strategic workforce planning is established and the factors and data used for analyzing different talent challenges along with the prospective predictive modeling methods are discussed. However, these modeling techniques are still developing, and more accuracy on results will be achieved on the future.

With more data ever, workforce-related decisions will be more revolutionized and keep evolving realizing the potential of Analytics in the future.

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