Modeling Employee Life Time Value (ELTV)

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Abstract

Employees form the most expensive asset of an organization. Human capital is behind every innovation, technological breakthroughs, and growth of any organization. The organization must be able to measure the value of the people and invest in them appropriately to make them feel valued. *Employee Life Time Value (ELTV)* is one such metric measuring the financial value, the employee brings to the organization. Estimating the ELTV helps the decision-makers in both HR and business line managers to plan the alternative actions build a team with an optimal ELTV. ELTV can be used in pre-recruitment and post recruitment covering all the Employee Life Cycle touchpoints. This paper proposes a five-stage framework to measure the value of an employee. First, a rule-based model for employee cost/revenue computations; second, an ML-based model for computing the performance score; third, an ML-based model (using Auto-ML) to predict the attrition propensity; fourth, computation of the ELTV per employee; fifth, profiling the employees based on ELTV and Performance to segment them into four quadrants to help in managerial decision making. This also brings the concept of *Money ball in HR*, building high performance team with higher financial value per employee.

Keywords: Employee Life Time Value, Attrition Model, Performance Analysis, Money Ball in HR

I. INTRODUCTION

Companies spend anywhere between 60% and 70% of their revenue on human resources and thus making it as the single biggest cost [1] [10]. Most organizations continue to hire and develop employee talent using intuition-based decisions. There is no evidence that such decisions are effective and repeatable. The literature suggests that one of the essential metric to measure the human capital decisions is to understand the Employee Life Time Value (ELTV) [2].

Employee Lifetime Value represents the total net value over time that an employee brings to an organization [3]. Calculating ELTV per employee could be valuable to understand what each employee brings to the table which can, in turn, help the management to implement the concept of *money ball* for HR. The concept of Money ball, popularized by Michael Lewis through his famous book, throws light on how to build a winning team despite low budget and resources [5] [6].

ELTV is the economic value an employee or a single human capital brings to the organization. Unlike Customer Life Time value (CLTV) [17] [18] outcome where the cost of improving the value is less, the cost of retaining high-value employees' is higher. Estimating the ELTV helps the decision-makers in both HR and business line managers to plan alternative actions for optimal ELTV. ELTV can be used pre-recruitment and post recruitment covering all the Employee Life Cycle touchpoints. In a highly competing market to acquire the best resources, HR managers are often left with lesser resources. An integrated approach of ELTV and Money Ball concepts in managing human resources could help the companies to build a winning team at a lower cost.

II. LITERATURE REVIEW

A. Employee Life Time Value

ELTV is a nascent concept and researchers still debate on capturing the true value of an employee in building an organization. Based on one such recent study by Pasha Roberts [10], ELTV is defined as "a prediction of the net profit attributed to an employee through the employee's tenure in a given role". This study presents an ELTV model based on three important metrics, Cost, Performance, and Tenure. Our attempt to extend this work and develop a

predictive model adding a fourth dimension to the computation, which is Revenue generated per employee.

B. Employee Tenture

Employee tenure or survival score or attrition score is a well-researched area in HR. Attrition refers to the separation of the employee with the organization. The voluntary attrition of high-value employees is costly and retention strategies are to be administered proactively. Multiple techniques have been used in attrition modelling from Logistic Regression [7] [10] to Random forests to Survival analysis [10] [11] [12]. However, as mentioned by Pasha [10], that though individual attrition probability score can be modelled, one cannot predict clearly when the employee will attrite, in months or in years.

C. Employee Cost

Employee Cost consists of recruiting cost, onboarding costs, training costs, salary and benefits, replacement cost etc [10]. However, we are yet to see HR systems capturing various costs incurred per employee. This study is limited to the base salary and benefits as the employee cost due to the data availability.

D. Employee Performance

This is another critical component to be considered while calculating ELTV. Generally, organizations follow a well-defined performance appraisal system which can capture various parameters of the given job role. Performance ratings are usually obtained from supervisors, peers and self to bring in a 360-degree perspective [15]. Simha et.al [8], have developed a framework for analyzing the performance in a software industry using neural networks and fuzzy logic. They have shown how the expectancy and actual performance can be used to analyze and recommend the actions for the dissonance or gap between expectation and actual work.

E. Employee Revenue

Employee Revenue is an important metric which needs to be considered. Certain roles like sales or production are directly linked to revenue and they have defined revenue targets. In a typical performance appraisal system, scores are linked to achieving those targets. However, rest of the roles contribute indirectly to the top-line revenue and hence become difficult to measure. Revenue per employee is a well-accepted HR metric to capture productivity of an organization. For Eg, Whatsapp, which was acquired by Facebook at a whopping $19-billion, had only 55 employees showing an exceptionally productive team [16].

Marlena [4], argue that job quality, which is measured as a misfit between expectations towards work and its perceptions, influences both employee engagement and retention, which are key drivers of employee lifetime value. Hence performance analysis becomes one of the critical factors to be monitored on a regular basis.

It has been observed that limited work is available for ELTV, which can be used for multiple decision across the employee life cycle. In this work we propose a hybrid model framework which combines the rule-based and machine learning approaches to optimize the ELTV. It is based on four dimensions; cost, performance, revenue and attrition propensity of an employee. Hence it combines multiple sources of information like cost and revenue (financial), performance (Operations) and attrition (HR) to arrive at an approximately correct value of ELTV.

III. METHODOLOGY

The proposed framework consists of 4 categories of computations:

- Rule-based model for cost/revenue computations
- ML-based models (using Auto-ML) to predict the attrition propensity
- Computation of the ELTV
- Identifying the profiles of the Money Ball Employees

In the first module, the profitability of an employee using the revenue and cost is computed using the standard functions of the organization. In the current work relatively apportioned cost and revenue model is used to compute the profitability [16].

In the second module an Auto-ML based algorithm is used to compute the attrition propensity of each employee, based on the demographic, behavioural and psychographic attributes. One of the contributions of this work is experimenting with Auto-ML, which is not widely used in attrition modelling at present.

In the third module, the ELTV is computed as a function of the cost, performance score and the propensity for attrition. Once the ELTV is processed, a decision tree algorithm is used to understand the factors affecting the different segments of ELTV. The insights discovered from this module will be used to define the factors affecting the lifetime value and improve it.

The proposed framework is tested on a human capital data set from a large multinational pharmaceuticals company. The results are discussed

along with the possible actions to improve the ELTV. Future work is under progress to link the ELTV modelling with the rest of the Employee Life Cycle Analytics framework.

F. Assumptions and limitations

While the data belongs to the active and attrited employees of a well-known medical research organization, and hence is real-time, ELTV being a complex concept, the data always remain inadequate. The current work has considered only the employees at least a year of experience in the same company. And hence while considering the cost incurred, this study has not taken into account the discounted money value. The study has considered only the direct cost, such as salary and benefits and excluded the indirect cost, like acquisition cost, onboarding costs, training cost etc. This study also excludes very senior positions like VP and above since their numbers are smaller and their contribution to the organization need to be appraised using appropriate parameters. Further work will be carried out with profiling the best and high tenure performers, for recruitment guidelines.

IV. CONCEPTUAL DESIGN

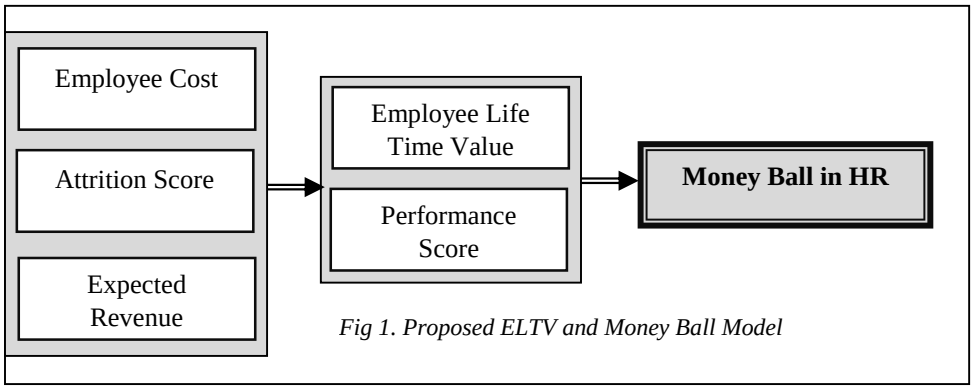

Fig 1. Proposed ELTV and Money Ball Model

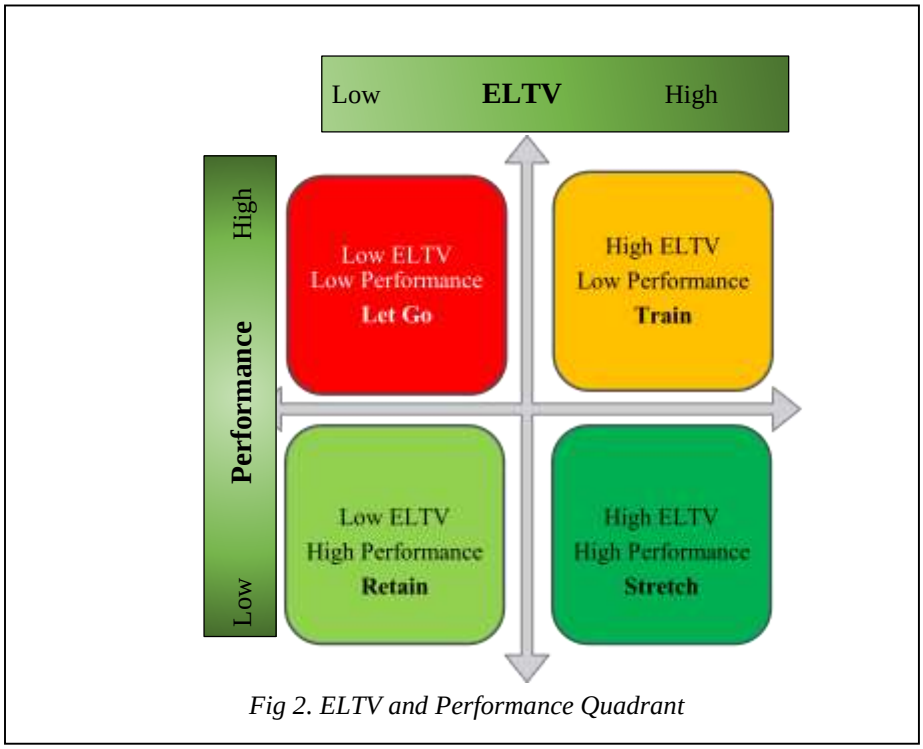

Fig 2. ELTV and Performance Quadrant

A. *ELTV Computation*

The Employee Lifetime Value (ELTV) is based on three parameters – Expected revenue, Attrition probability and cost of the human capital. The equation used to compute the ELTV is given as:

$$\mathbf{ELTV = \alpha_i \, X \, \rho_i \, X \, \lambda_i} \quad \text{……..(1)}$$

Where α_i = Attrition probability derived from a predictive model for the human capital i

ρ_i = Expected revenue for the human capital i and

ρ_i = Cost or compensation for the human capital i

V. RESULTS AND DISCUSSIONS

The experiments were conducted based on the approach discussed in the previous sections. The resources are segmented, attrition model for each segment are developed and used for scoring/assigning the attrition probability, ELTV is computed for each resource and finally, the recommendation for the retention is presented.

A. *Segmentation*

Based on the segmentation scheme defined by the domain team, the job roles were chosen to stratify the resources. Junior and senior executives were formed *'segment 1'*, mid-management formed the *'segment 2'* and the senior management constituted the *'segment 3'*. Top management above VP level are not included in the study as these positions are more strategic than tactical. The distributions for the active and attrite in each segment are as follows:

	Active	**Attrite**	**Attrition %**
Segment 1	744	233	24
Segment 2	610	175	22
Segment 3	99	9	8

Table 1. Segmentation scheme

Attrition rates are different in each segment as per the Table 1. Attrition is very high in the executive and the mid-management level and relatively less in senior management level. The ratio of the difference is for every attrite in senior management segment, the attrition in the other two segments is approximately between 2.5 to 3 times. Since the experience, compensation and expectation from each segment is different, there will be different behavioural patterns for attrition and as after effect the ELTV. Hence it is necessary to build the attrition model for each of the segments and establish the ELTV for each segment separately.

B. *Attrition modeling*

The different models defined in the previous section have been developed using the real-world data set. Prediction accuracy, True Positive Rate (TPR) and the coverage (the actual number of attrite identified as a percentage of total attrite) are used to evaluate the model. The best model is used to score the resources for use in ELTV modeling. The results of the experiments are given below:

Segment 1 - Executives

	Accuracy	TP Rate	Coverage
Naïve Bayes	0.91616	0.74051	1
Logistic regression	0.78528	1	0.10256
Decision tree	0.90798	1	0.61538
Random forests	0.98978	1	0.95726
Support Vector Machi	0.99796	1	0.99145
Neural networks	**1**	**1**	**1**

Segment 2 - Mid Management

	Accuracy	TP Rate	Coverage
Naïve Bayes	0.73469	0.30579	0.97368
Logistic regression	0.89796	1	0.07895
Decision tree	0.9621	1	0.65789
Random forests	0.99417	1	0.94737
Support Vector Machi	1	1	1
Neural networks	**1**	**1**	**1**

Segment 3 - Senior Management

	Accuracy	TP Rate	Coverage
Naïve Bayes	0.12963	0.07843	1
Logistic regression	0.92593	0	0
Decision tree	0.92593	0	0
Random forests	0.98148	1	0.75
Support Vector Machi	0.98148	1	0.75
Neural networks	**1**	**1**	**1**

Table 2. Results of attrition modeling

It can be observed that the majority of the models have higher accuracy (more than 70%) and higher True Positive rate (more than 70%), only few models have higher coverage i.e the models' ability to detect most of the human capital at risk. The naïve Bayesian model performs worse on segment 3, with all metrics being poor. The results indicate that all the segments have nonlinear patterns for attrition behavior in general, evident from all the metrics. In particular the neural network models showed highest accuracy, TP rate and coverage. Hence the neural network models are selected as the predictive models for assigning the

attrition probability. These results are further used to compute the ELTV.

C. ELTV Modeling

Using the formula of discounted revenue as discussed in section IV, the ELTV was computed, which is a function of potential revenue, cost and probability of attrition. One of the assumptions in compensation is that 'higher the compensation, better will be the ELTV', hence retain those resources. However, it is necessary to analyze the compensation against the ELTV. This can be done with ELTV profile using a domain defined range for categorization. The completed ELTV profiles for different segments are as follows:

Table 3. ELTV of Segment 1-Executives

Compensation	High	Low	Total
High	694	190	884
Low	60	33	93
Grand Total	**754**	**223**	**977**

Table 4. ELTV of Segment 2-Mid Management

Compensation	High	Low	Total
High	574	107	681
Low	0	4	4
Grand Total	**574**	**111**	**685**

Table 5. ELTV of Segment 3-Senior Management

Compensation	High	Low	Total
High	29	2	31
Low	70	7	77
Grand Total	**99**	**9**	**108**

D. Recommendation

The recommendation for retention will be based on the ELTV and performance. Though it is assumed that the human capital at risk of flight should be retained, the ROI of all retained may not be same. Hence the retention strategy should be based on the performance and ELTV, with an optimization scheme to maximize the returns. The decision to set the ELTV optimization will be the discretion of the management and can set the guidelines for the strategies. In general high ELTV resources will be retained or improved, while low ELTV resources are to be put on remedial interventions. The decision support guidance for designing a strategy for different models are shown below:

Table 6. Snapshot of Segment 1-Executives

	ELTV		
Performance	Low	High	**Total**
0	**205**	147	352
1	**1**	45	46
2	**7**	125	132
3	9	372	381
4	1	65	66
Grand Total	**223**	**754**	**977**

Table 7. Snapshot for Segment 2-Mid Management

	ELTV		
Performance	Low	High	**Total**
0	**25**	90	115
1	**6**	6	12
2	**20**	60	80
3	48	318	366
4	12	100	112
Grand Total	**111**	**574**	**685**

Table 8. Snapshot Segment 3-Senior Management

	ELTV		
Performance	Low	High	**Total**
0	**7**	5	12
1	**1**	5	6
2	**1**	17	18
3	0	55	55
4	0	17	17
Grand Total	**9**	**99**	**108**

Table 9. Cumulative results

	ELTV		
Performance	Low	High	**Total**
0	237	242	
1	8	56	**773**
2	28	202	**(44%)**
Total	**273 (15%)**	**500 (28%)**	
3	57	745	**997**
4	13	182	

Total	**70 (4%)**	**927 (52%)**	**(56%)**
	343	1427	

VI. RESULTS AND DISCUSSIONS

The tables 6-9 shows the snapshots with the number of employees falling into each of the categories as discussed in fig.2. The four categories are:

- Low ELTV, Low Performance –indicated in red, consists of 15% of the total employees and forms the top left quartile. Low ELTV indicates that they are costly to the organization and are poor performers. These resources are to be looked critically for inefficiency in generating good
- ELTV. The management may decide to let them go or take them through an individual development plan.
- High ELTV, Low Performance – 28% of the employees in this data set, are in this quadrant. Since they bring value to the organization, either in terms of revenue or lower cost, further investigation could be made to either train or motivate them to bring up the performance.
- Low ELTV, High Performance – Light green quadrant occupants are consistently shown higher performance and hence, they could be moved to projects which can yield higher returns and ELTV.
- High ELTV, High Performance – They contribute significantly to the organization's results and are rated as high performers. 52% of them are in this quadrant, which is a positive signal indicating a high performance and high value culture in this organization.

The concepts of ELTV and money ball brings in a strategic dimension to HR's contribution to the organization. After all, it's the human capital which makes a winning organization. The role of HR is to enable to build a performance and value-driven organizational culture. This study provides a data-driven approach to measure the value of each employee bringing to the organization. Based on the four quadrants the HR and Business Units must be able to take pro-active measures to move the organization culture into a winning one.

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