Predicting Employee Satisfaction of Academics in Sri Lankan Universities: Ordinal Regression Approach

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Abstract— **The study examined the components of job satisfaction and its predictive measures on job satisfaction of academics in Sri Lankan Universities. The study employed a descriptive research of the survey type to describe and interpret the components of job satisfaction of academics in Sri Lankan Universities. A questionnaire was used to collect information from respondents. The factors collected from the questionnaire includes demographic factors and 7 other factors namely superior behavior, co-worker behavior, job itself, physical conditions, teaching and Research, administrative duties, academic environment and freedom. Two hundred and thirty academics from various universities were responded. Haphazard Sampling was used in selecting the respondents, from state and non-state Universities. Data were analyzed using ordinal regression. Reliability analysis was applied to check the internal consistency of all the seven factors. The study revealed that, superior behavior, job itself and freedom are the significant factors for employee satisfaction. Further, the results indicated that fitting of the abilities and knowledge with the job, ability to use the full potential in work are significant factors in predicting employee satisfaction of academics in Sri Lanka. R-square value was 28.7% and therefore model explains 28.7% of the variation from the dependent variable. Recommendations were made based on the findings that the administrators and management of the Universities should give attention and priority to those variables that would promote job satisfaction among the academics of the Universities.**

Keywords- Employee Satisfaction, Academics, Demographic data, Reliability Analysis, Ordinal Regression

I. INTRODUCTION

A high-quality academic staff is the foundation of an effective educational system. Therefore, it is necessary to pay attention to satisfaction of the academic members. A positive and healthy university structure results in increased academic staff's job satisfaction. A good university atmosphere will not only increase the employee satisfaction of academic staff, but it will at the same time develop the learning environment. Employee satisfaction is affected by internal and external motivating factors such as the supervisor behavior, co-worker behavior, and individual success or failure in their work [15].

Academic staff is essential and the most vital component in the process of achieving the mission and vision of an educational institute [14]. Because academic staff members are the first line of contact with students and require complex work in an increasingly demanding environment [26].To meet the relevant standards of education, academics need an environment that allows them to work freely without problems. According to [23], satisfaction has been extensively studied in the management literature due to its importance to the physical and mental wellbeing of the employee. Therefore it is essential to determine the factors affecting academic staff members' satisfaction. Also, this will be useful to recognize that, which factors should be maintained by an institute/university to increase the employee satisfaction. [21] Proposed that university lecturers fulfill three major functions, namely teaching, researching and administration and management. Consequently, university lecturer satisfaction is related to the functions of higher education. According to [18] there are two types of job satisfaction which are based on the feelings of employees regarding their jobs. The most studied is global job satisfaction, which indicates the overall feelings of employees about their jobs. The second type of job satisfaction is job facet satisfaction, which refers to feelings about specific job attributes, such as salary, benefits, and co-worker behavior. This questionnaire can measure above mentioned both types of job satisfaction.

When it measures employee satisfaction, most of the variables are categorical variables. Therefore this analysis

involves categorical data analysis. Most of the previous researches in the same context have used certain statistical techniques which are not appropriate in categorical data analysis. For example, the Ordinary Least Squares method is used to predict a dependent variable with one or more independent variables. This method is used for continuous dependent variables [1]. Use of such inappropriate mathematical models can lead to bias and misconception of research findings. Another most common mistakes in a predictive model is to use statistical variable selection algorithms to identify causes.

Thus, this research proposes to apply an ordinal logistic regression model to predict the employee satisfaction. Employee satisfaction itself is an ordinal variable and ordinal outcomes are analyzed with the ordinal logistic regression. This method is well apposite in scenarios when there is an ordinal dependent variable.

II.   LITERATURE REVIEW

Different statistical methods such as descriptive statistics, chi-square tests, linear regression, multilevel modeling, and ordinal regression techniques have been commonly found in the literature to analyze satisfaction questionnaires to study satisfaction about various explanatory variables. These methods investigate the association between the explanatory variables and the outcome variable. Some of the previous researches which have used different statistical techniques are reviewed below.

A.   Ordinal Regression

Following are some of the researches which have used ordinal regression in modeling data. Ordinal regression is used in many different areas and some of them are discussed below.

[28] Has done a research to measure job satisfaction of the staff in call centers. This study expands the use of statistical models, Ordinal Regression Models and links various factors affecting job satisfaction.

[3] Aims to build a model to predict overall customer satisfaction in a student-operated restaurant. Data had collected using a close-ended questionnaire and had distributed using a convenient random sampling approach. A neural network model and a logistic regression model were built to predict overall customer satisfaction.

[5] Has carried out a study to evaluate the job and personal satisfaction rates in physicians who work in adult intensive care units and to identify the factors associated with satisfaction. A questionnaire designed to assess the physician's socio-demographic profile and the job was available for both groups for 3 months. Variables independently associated with satisfaction were identified using a logistic regression model.

[16] Aims to provide a tool for measuring air passenger satisfaction and for identifying the critical service aspects available in the terminal in order to offer services characterized by a high level of quality. Modeling is done by the logistic regression approach.

[13] Has developed a method termed Ordinal Logistic Biplot to measure the job satisfaction of doctorate degree holders in Spain.

[25] Is an application of ordinal regression and back pain is measured as an ordinal measurement, therefore, to manipulate this variable ordinal regression methods are applied. Two ordinal models (the proportional odds and the continuation ratio models) are compared, and the goodness-of-fit of these models are examined.

In [9], ordinal regression method was used to model the explanatory variables concerning demographics and the outcome variable for student satisfaction which was measured on an ordered four-point Likert scale. Explanatory variables included gender and ethnic groups, and 42 questionnaire items related to the satisfaction of faculty involvement, curriculum contents, support services, facilities, and leisure activities at the college.

According to literature, most of the researches that have used ordinal regression are from the fields of clinical research, epidemiological studies, applications in geography, ecological studies and cost estimations. But very fewer applications are from employee satisfaction domain. Some of those researches are reviewed above.

B.   Employee Satisfaction

Following are some of the past researches that have been done in the employee satisfaction domain.

Researches were carried out to measure the employee satisfaction of the academics. [22] Determines the perception of organizational climate has a significant effect on the job performance of some academics in Thailand. This study has used MANOVA and descriptive statistics for the analysis process. Since the questionnaire used by [22] is reliable, this study has also used the same questionnaire with few modifications. Another study has been carried out in the higher education sector and [20] investigated job satisfaction among university professors. In here cluster analysis was used.

In [8], they have used different statistical techniques such as reliability analysis, factor analysis, correlation analysis, and regression analysis. They have used the Kaiser-Meyer-Olkin (KMO) test, and Bartlett's Test of Sphericity to measure the adequacy of the data. Eventually, they have obtained a model for Employee Satisfaction. In [2] also, they have used Regression Analysis and reliability analysis. Same as in [8] they have derived a regression model for employee

satisfaction and here it has considered more independent variables.

In [12], it has used multivariate analysis and clustering techniques which are the same approach as [20]. Using these methods, it has clustered the employees into three categories.

To measure the satisfaction levels of higher education teachers [7] has carried out a study. This study had issued a questionnaire to all teachers at a Higher Education Institute in Taiwan. Reliability analysis is carried out, and it has determined which quality attributes must be improved to raise employee satisfaction.

In [14], the study is carried out to measure the employee satisfaction of the academics in government and private universities in Sri Lanka. This study has used both primary and secondary data. It has used statistical techniques such as Student's t-tests and one-way ANOVA tables though it is suitable to use techniques related to categorical data analysis. This analysis had not gone through a profound statistical analysis.

Most of the researches reviewed above are related to employee satisfaction. Some of them have used linear regression analysis, and some have used statistical methods such as Student's t-test, ANOVA and MANOVA, which are not appropriate to use with ordinal dependent variables.

After reviewing the literature, superior behavior, co-worker behavior, job itself, physical environment, teaching and research, administrative duties, academic environment and freedom were considered as factors to be tested against employee satisfaction.

III. MATERIALS AND METHODS

A. Research Design

This study is a survey research, and it is based on the data collected through the questionnaire. The unit of analysis is an academic from a Sri Lankan University.

B. Population and Sample

In this context, the population is all the university academics in government and private both sectors in Sri Lanka. There are seventeen state universities, nine Institutes and seven Post Graduate institutes available in the Tertiary Education system in Sri Lanka. Currently, there are 15 government universities in Sri Lanka. All these government universities employ around 5440 permanent university lecturers in all the universities according to "Sri Lanka University Statistics – 2016" [27]. Still, there is no record on the number of academics in the private sector. However, the sample of the data should be composed of data from government and private universities both.

C. Data Collection

When collecting the elements for the sample, haphazard sampling was used. It is a non-probability sampling technique. With this sampling technique elements are selected in an aimless and assume that the population is homogeneous. The rationale for using this sampling method is due to lower cost, speedy data collection, and availability of population selection. Data collection was done from December 2017 to January 2018. 1116 questionnaires were distributed among academics in all private and government universities in Sri Lanka, and only 260 responses were received. Out of all 260 responses, only 230 could be used for the analysis process since there were incompletely filled questionnaires. Hence the response rate was around 23.3% which is slightly a small value.

D. Questionnaire Design

For this research, the initial stage was to design the questionnaire. It was prepared based on previous research and specifically [22] has considered. Questionnaire consists of some demographic data and different factors such as Superior behavior, co-worker behavior, the job itself, physical environment, teaching and research, administrative duties, academic atmosphere, and freedom. Collected demographic data include age, gender, academic rank, sector, the field of lecturing, years of service, salary, distance to work location, and the number of research papers published. The Questionnaire consists of six questions to measure employee satisfaction. There are altogether 37 questions to measure these eight factors. To measure the employee satisfaction, 6 questions are included in the questionnaire and it measures different aspects of satisfaction.

E. Data Analysis Methods

- **Formulating an ordinal logistic regression model**

The basic form of a Generalized Linear Model is given by the following equation.

$$1 \tag{1}$$

Where

link () is the link function

γ_{ij} is the cumulative probability of the jth category for the ith case

θ_j is the threshold of the jth category

p is the number of regression coefficients

$x_{i1}, \dots, x_{ip}$ are the values of the predictors for the ith case

$\beta_1, \dots \beta_p$ are regression coefficients

- **Link Function**

Function	Form	Typical Application
Logit	$log(\xi/(1-\xi))$	Evenly distributed categories
Complementary log-log	$log(-log(1-\xi))$	Higher categories more probable
Negative log-log	$-log(-log(\xi))$	Lower categories more probable
Probit	$\phi^{-1}(\xi)$	Latent variable is normally distributed
Cauchit (Inverse Cauchy)	$tan(\pi(\xi-0.5))$	Latent variable has many extreme values

TABLE 1.   LINK FUNCTIONS

link() is a transformation of the cumulative probabilities that allows estimation of the model. Five link functions are available, and they are given in table 1.

- Measures of Model Fit

There are five scalar measures of model fit: (1) Deviance; (2) McFadden's; (3) Cox and Snell Pseudo; (4) Nagelkerke Pseudo and (5) Test of Parallel Lines. There is no convincing evidence that selection of a model that maximizes the value of a given measure necessarily results in a model that is optimal in any sense other than the model having a bigger (or smaller) of that measure [17]. However, the residual analysis was also used to measure the goodness of fit of the model.

IV.   RESULTS AND ANALYSIS

This section presents an analysis of the data using ordinal regression. Main factors and demographic data were analyzed with employee satisfaction.

A.   Ordinal Regression Analysis of Demographic Factors and Employee Satisfaction

The demographic factors collected are age, gender, academic rank, sector, the field of lecturing, years of service, salary, distance to work location and number of research papers published. Questionnaire includes six questions to measure employee satisfaction which can be considered as six variables. Thus, to form one dependent variable, the mode of all the six variables was taken. Considering this variable as the dependent variable and demographic factors as independents, ordinal regression was applied and the SPSS outputs are as follows.

TABLE 2: MODEL FITTING INFORMATION FOR THE MODEL BETWEEN EMPLOYEE SATISFACTION AND DEMOGRAPHIC FACTORS

Model	-2 Log Likelihood	Chi-Square Value	Degrees of Freedom	Significance
Intercept Only	148.895			
Final	114.342	34.553	5	.000

Hypothesis underlying the table 2 is as follows.

H_0: Baseline-Intercept only model is significant
H_1: Final model gives a significant improvement over the baseline-intercept model

Table 2 gives significance value as 0.000 and it is less than 0.05. Therefore it indicates that the model is significant at 5% level of significance.

TABLE 3: GOODNESS-OF-FIT TESTS FOR THE MODEL BETWEEN EMPLOYEE SATISFACTION AND DEMOGRAPHIC FACTORS

	Chi-Square	Degrees of Freedom	Significance
Pearson	35.997	31	.246
Deviance	35.275	31	.273

Hypothesis tests underlying the above goodness-of-fit tests are as follows.

H_0: Model is consistent with the data
H_1: Model is not consistent with the data

According to Table 3, the significance values of the goodness-of-fit tests are all greater than the significance level of 0.05, which indicates that there is not enough evidence to conclude that the model does not fit the data. Therefore data has become consistent with the model.

TABLE 4: PSEUDO R-SQUARE VALUES FOR THE MODEL BETWEEN
EMPLOYEE SATISFACTION AND DEMOGRAPHIC FACTORS

Cox and Snell	.141
Nagelkerke	.155
McFadden	.063

Table 4 gives pseudo R-square values for the model. Cox and Snell R – square is 0.141 and Nagelkerke R square is 0.155. This indicates the amount of variation of the dependent variable explained by the independent variables. It is around 15% and the reason behind that could be having just 2 predictors (sector and salary) in the model.

Parameter estimates table of the model is given in the Appendix. According to the results, all the categories of the sector have become significant. This indicates that both government and private sectors have an influence on employee satisfaction. But all the categories of salary are not significant and only the lowest category has become significant. Therefore it shows that academics with lowest category of salary has a significant influence on employee satisfaction.

TABLE 5: RESULTS OF THE TEST OF PARALLEL LINES FOR THE MODEL BETWEEN EMPLOYEE SATISFACTION, SECTOR AND SALARY

Model	-2 Log Likelihood	Chi-Square	Degrees of Freedom	Significance
Null Hypothesis	114.342			
General	93.058	21.284	15	.128

Hypothesis underlying Table 6 is as follows.

H_0: The slope coefficients in the model are the same across response categories (Accept the proportional odds assumption)
H_1: Ordered logit coefficients are not equal across the levels of the outcome (Reject the proportional odds assumption)

Table 5 gives the results of the test of parallel lines. Significance value is 0.128 and it indicates that the null hypothesis is not rejected at 5% significance level. Hence this test provides evidence to accept the proportional odds assumption.

B. Reliability Analysis

Cronbach's alpha is used to determine the reliability, or internal consistency, of a set of variables. In other words, Cronbach's alpha is one way of assessing the strength of that consistency [11]. To measure the internal consistency of the questions in a one factor, this method can be used. According to the results, except supervisor behavior, all the other factors have a positive Chronbach's alpha value. To measure supervisor behavior there are five questions, and there are negatively related questions and that can be the reason to obtain negative values for the Chronbach's alpha. Therefore to overcome this problem two questions from supervisor behavior were re-coded. Once the first and third questions are recoded, Chronbach's alpha was again calculated, and the resulting value was 0.812 which is an acceptable value. It indicates that, now the items in superior behavior are internally consistent.

C. Ordinal Regression Analysis of Main Factors and Employee Satisfaction

Questionnaire includes 8 main factors which comprises of 37 questions. Since there are 6 questions to measure employee satisfaction, to obtain a single dependent variable the mode of all the 6 questions was taken. By considering this variable as the dependent variable and all 37 questions as independent variables, ordinal regression was applied. Then 2 different models were obtained.

TABLE 6: SIGNIFICANT ITEMS IN MODEL I

Question	Main Factor	Question
Q13	Superior Behaviour	I have no doubt that my superior is going to support me in every condition
Q31	Job Itself	I can use my full potential in my job
Q32	Job Itself	My job fits my abilities and knowledge
Q83	Freedom	I am allowed to give lectures in other Universities

Significant questions in the model I are presented in Table 6. Results indicated that, superior behavior, job itself and freedom are significant factors on employee satisfaction.

TABLE 7: SIGNIFICANT ITEMS IN MODEL II

Question	Main Factor	Question
Q47	Physical Conditions/ Working Experience	Sport centers
Q61	Administrative Duties	Non-academic activities are taking so much time
Q72	Job Itself	The problems of academics are solved immediately in my university
Q83	Freedom	I am allowed to give lectures in other Universities

Table 7 gives the significant items in model II and it shows that physical environment, job itself, freedom and administrative duties have a significant influence on employee satisfaction. Comparison between the 2 models is presented in the following table.

TABLE 8: COMPARISON BETWEEN MODEL I AND MODEL II

Criteria	Model I	Model II
Cox and Snell R-Square	0.261	0.242
Nagelkerke R-Square	0.287	0.266
Significant value of the Test of Parallel lines	0.000	0.000

According to Table 8, Model I has the higher R-square value and it indicates that Model I is able to explain higher amount of variation from the variation of the dependent variable.

According to the results of the test of parallel lines for the model I and model II, significance value are all less than 0.05. Therefore it indicates that the proportional odds assumption is violated. However the test of the proportional odds assumption has been described as anti-conservative,

that is it nearly always results in rejection of the proportional odds assumption [19] particularly when the number of explanatory variables is large [6], the sample size is large [4] [24] or there is a continuous explanatory variable in the model [4]. Here the statistical test that led to the rejection of the proportional odds assumption probably reflects the large sample size and the large number of explanatory variables in the dataset.

Further, to check the model fit, residuals can be used. Almost all of the Pearson residuals are less than 2 for Model I and Model II and therefore it can be concluded that the both models fit the data well.

By considering significance of the model, goodness-of-fit tests, pseudo R-square values, residuals and the results of the test of parallel lines the best model can be obtained. Almost all the results are similar and only the R-square values are different. R-square values are higher in Model I and therefore it can be concluded that Model I is the best model out of the two models.

Predicted probabilities for the model I can be calculated as follows. Parameter estimates used to calculate these probabilities are given

$$P(Employee\ Satisfaction = 4)$$
$$= \frac{1}{1 + e^{-3.1*(Q32=1)-1.9*(Q32=3)-1.2*(Q32=4)-3.3*(Q83=1)-1.8*(Q83=2)-1.5*(Q83=3)}{-(0.544 - 2.0*(Q13=1)+3.1*(Q31=1))}}$$

$$P(Employee\ Satisfaction \geq 3)$$
$$= \frac{1}{1 + e^{-3.1*(Q32=1)-1.9*(Q32=3)-1.2*(Q32=4)-3.3*(Q83=1)-1.8*(Q83=2)-1.5*(Q83=3)}{-(-3.053 - 2.0*(Q13=1)+3.1*(Q31=1))}}$$

$$P(Employee\ Satisfaction \geq 2)$$
$$= \frac{1}{1 + e^{-3.1*(Q32=1)-1.9*(Q32=3)-1.2*(Q32=4)-3.3*(Q83=1)-1.8*(Q83=2)-1.5*(Q83=3)}{-(-4.194 - 2.0*(Q13=1)+3.1*(Q31=1))}}$$

$$P(Employee\ Satisfaction \geq 1)$$
$$= \frac{1}{1 + e^{-3.1*(Q32=1)-1.9*(Q32=3)-1.2*(Q32=4)-3.3*(Q83=1)-1.8*(Q83=2)-1.5*(Q83=3)}{-(-5.511 - 2.0*(Q13=1)+3.1*(Q31=1))}}$$

D. Conclusion

This study was conducted to evaluate and determine the main factors affecting employee satisfaction of academics in Sri Lanka. Ordinal regression is used to analyze demographic factors and all 7 factors namely superior behavior, co-worker behavior, the job itself, physical conditions, teaching and Research, administrative duties, academic environment and freedom against the employee

satisfaction. All these seven factors were measured by 37 questions included in the questionnaire. Results obtained from the analysis can be incorporated to increase the employee satisfaction of the Sri Lankan academics in the future.

Findings obtained from the analysis indicated that, out of all the demographic factors, sector and salary were significant in predicting employee satisfaction with ordinal regression. According to the model, sector and salary can explain 15.5% of the variation of employee satisfaction. As suggested by [10], this study also confirms that salary is related to employee satisfaction.

Reliability analysis is used in many types of research. In here also to check the internal consistency of the individual factors, reliability analysis was applied. Chronbach's alpha was used for this purpose and it was a negative value for the first factor (Superior behavior). In order to make it internally consistent two questions were re-coded and it resulted in an acceptable Chronbach's alpha value which shows that all 5 items in superior behavior are internally consistent.

Ordinal regression resulted in 2 different models and the best model. By considering significance of the model, goodness-of-fit tests, pseudo R-square values, residuals and the results of the test of parallel lines, the best model can be obtained. Model I has shown that superior behavior, the job itself and freedom are significant factors in predicting employee satisfaction. That is, this analysis has found that fitting of a job with abilities and knowledge, use of the employer's full potential in the job, superior's behavior and freedom are significant factors in the model. However, the R-square value is 28.7% for this model and therefore it indicates that this model is explaining 28.7% of the variation of the dependent variable. [22] Has found that co-worker's behavior, the job itself and freedom are significant factors on employee satisfaction. Therefore it shows that there is a slight difference between the results of this study and the results of [22]. But most of the significant factors in this study were much similar to [22]. Therefore this study has inspected the satisfaction levels of the academics in Sri Lankan Universities and offers appropriate recommendations for the top level administration.

E. Future Work

As future work, selecting a sample using a probability sampling technique can be suggested. This research has used haphazard sampling, which is a non-probability sampling technique. Using a probability sampling technique gives more accurate results than non-probability sampling technique.

This research has applied ordinal regression. As future work, some other analysis methods can also be applied. Regression methods such as Categorical regression, multinomial logistic regression can be applied to predict the employee satisfaction and further comparisons can also be done in between the different methods.

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Appendix I: Parameter Estimates for the model I

		Estimate	Std. Error	Wald	Degrees of Freedom	Significance	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Employee Satisfaction = 1]	-5.511	.824	44.768	1	.000	-7.125	-3.897
	[Employee Satisfaction = 2]	-4.183	.774	29.216	1	.000	-5.700	-2.666
	[Employee Satisfaction = 3]	-3.053	.750	16.562	1	.000	-4.524	-1.583
	[Employee Satisfaction = 4]	.544	.711	.585	1	.444	-.850	1.938
Location	[Q13=1]	-2.072	.776	7.131	1	.008	-3.593	-.551
	[Q13=2]	.210	.574	.133	1	.715	-.916	1.335
	[Q13=3]	-.328	.511	.411	1	.522	-1.329	.674
	[Q13=4]	-.160	.489	.107	1	.744	-1.119	.799
	[Q13=5]	0[a]	.	.	0	.	.	.
	[Q31=1]	3.143	1.076	8.524	1	.004	1.033	5.253
	[Q31=2]	.067	.517	.017	1	.898	-.947	1.080

[Q31=3]	.351	.560	.392	1	.531	-.747	1.448
[Q31=4]	.492	.389	1.599	1	.206	-.271	1.256
[Q31=5]	0[a]	.	.	0	.	.	.
[Q32=1]	-3.111	1.053	8.736	1	.003	-5.174	-1.048
[Q32=2]	-.782	.927	.711	1	.399	-2.599	1.035
[Q32=3]	-1.874	.579	10.487	1	.001	-3.008	-.740
[Q32=4]	-1.238	.356	12.072	1	.001	-1.937	-.540
[Q32=5]	0[a]	.	.	0	.	.	.
[Q83=1]	-3.318	.718	21.368	1	.000	-4.724	-1.911
[Q83=2]	-1.827	.643	8.067	1	.005	-3.088	-.566
[Q83=3]	-1.490	.612	5.935	1	.015	-2.688	-.291
[Q83=4]	-.516	.578	.797	1	.372	-1.650	.617
[Q83=5]	0[a]	.	.	0	.	.	.