



THE VIABILITY OF NEURAL NETWORK FOR MODELING THE IMPACT OF INDIVIDUAL JOB SATISFIERS ON WORK COMMITMENT IN INDIAN MANUFACTURING UNIT

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Abstract. This paper provides an exposition about application of neural networks in the context of research to find out the contribution of individual job satisfiers towards work commitment. The purpose of the current study is to build a predictive model to estimate the normalized importance of individual job satisfiers towards work commitment of employees working in TVS Group, an Indian automobile company. The study is based on the tool developed by Spector (1985) and Sue Hayday (2003). The input variable of the study consists of nine independent individual job satisfiers which includes Pay, Promotion, Supervision, Benefits, Rewards, Operating procedures, Co-workers, Work-itself and Communication of Spector (1985) and dependent variable as work commitment of Sue Hayday (2003). The primary data has been collected using a closed-ended questionnaire based on simple random sampling approach. This study employed the multilayer Perceptron neural network model to envisage the level of job satisfiers towards work commitment. The result from the multilayer Perceptron neural network model displayed with four hidden layer with correct classification rate of 70% and 30% for training and testing data set. The normalized importance shows high value for coworkers, superior satisfaction and communication and which acts as most significant attributes of job satisfiers that predicts the overall work commitment of employees.

Keywords: job satisfaction, work commitment, Multilayer Perceptron neural network model, Training and Testing Dataset.

JEL Classification: M53.

Introduction

Job satisfaction is one of the core constructs in management and is the most extensively studied variable in organizational behavior and industrial psychology and it contributes more to the success of any organization.

According to Lease (1998), investigating job satisfaction is very essential because the employee who have higher job satisfaction tend to be more productive, extremely committed and loyal towards their organization and are highly satisfied towards their life. The success of organization depends on the appropriate use of manpower which will be an auxiliary to all other assets. The satisfied employees have greater morale, oneness and promote cohesiveness among

the members of the organization which leads to enhanced organizational performance.

1. Statement of the problem

The organizational performance is the outcome of work commitment rooted through job satisfiers. Thus the current study scrutinizes important factors of individual job satisfiers towards work commitment of the employees using neural network which is vital in the globalized competitive scenario. The majority of previous studies used logistic regression analysis and several statistical tools for analyzing the data and some study, compared neural networks with conventional statistical tools to evaluate the job satisfaction

attributes, but this is a study which uses neural network to find out the normalized importance of individual job satisfiers of employees towards work commitment and more specifically this study uses Multilayer Perceptron neural network model which is more advantageous than some of the other statistical tools like logistic regression analysis (Huang 2012). The application of neural networks in those days was mostly in finance and operations research such as detecting fraudulent customers and bankruptcy prediction (*cf.* Vellido *et al.* 1999). Although the usage of neural network in the field of organizational behavior was at the infancy stage, some studies used artificial neural networks to model employee turnover (Sexton *et al.* 2005). A research using computer simulation by (Seitz *et al.* 1997) analyzed the relationship between job tenure and turnover, and (Somers 2001) investigated relationship amid work attitude and job performance. Artificial Neural Networks is useful in projecting the ceiling point of explained variance when non-linearity is present. Since the relation exists in the study is a non-linear relationship the use of neural network in this study is not able to forgo. A non-linear association between two entities states that modification in one entity does not have any correspondence with the constant change in the other entity. In this study even if the pay, supervision satisfaction, promotion etc. exists for an employee, he may not get satisfied. In the field of organizational behavior Somers (1999) suggested that primary relationships amid variables might not be linear and called for the greater usage of nonlinear methods.

Multilayer Perceptron Networks (MLP Networks) and Radial Basis Function Networks (RBF networks) are the two popular methods of feed forward neural network. The MLP model is a supervised learning technique and it uses feed forward architecture because the data moves from the input layer to hidden layer and finally to the output layer. The reverse is not possible. It analyses the data set in three stages. The first stage is the “training process”. It tries to perceive the association between the variables in the dataset. Based on the learning’s of the first stage, it will attempt to discern a model and it is done in a hidden layer and is called hidden/Perceptron process. In this process, the optimal functions in the model are produced and dependent variables are assigned weights (W_i). In the third stage new model is estimated and it is called as the output process (Manel *et al.* 1999).

The distinguishing feature of neural network is to classify the dataset based on which strategic conclusions can be made by the organization. The Neural network is a computational tool based on which the data are clustered, and used for prediction. Neural networks randomly divide data into training (in-sample) and a testing set (out-sample). Neural network used training dataset to build the model and testing data set to estimate predictive capability of the model.

2. Review of previous literature

The most vital problem in an organization is to keep its employees committed towards work through job satisfiers. An organization having a highly satisfied and committed workforce will reach a pinnacle and will exercise a competitive advantage over the others. Job satisfaction is a psychological state combining both cognitive and affective indicators (Brief, Weiss 2002). This study analyses affective component of job satisfaction. One of the affective components, nature of the work itself can be a better predictor of job satisfaction (Saari, Judge 2004).

Various literatures discuss the variables that impact the level of employee satisfaction. For e.g., Bhuian *et al.* (1996) studied the influence of job satisfaction towards work commitment, Chi-Sum Wong *et al.* (1998), inspected the relationship between job perception and various facets of job satisfaction. Shukla, Sinha (2013) used linear correlation and found the key factors which influence employee turnover in banking sector. Another study by Rahman and Iqbal (2013) found that there exists an association between employee satisfaction and turnover among bank employees who are working in private sector. Shore and Martin (1989) revealed that job satisfaction has strong association with performance than organizational commitment and the relationship is linear. Carmeli and Freund (2004) in their study used path analysis using LISREL VIII and found that job satisfaction played a mediating role between joint work commitment and job performance.

Although lots of literatures are available on applications connected to productions/operations, marketing, finance and other functional areas (Wong *et al.* 2000) the studies that employ neural networks to analyze the behavioral perspective of employees (Wong *et al.* 2000) are fewer in number. Hence the current study uses Multilayer Perceptron of neural network to explore the relationship between job satisfiers such as pay, promotion, supervisor, benefits, rewards, operating procedure, coworkers, work and communication and work commitment and also to identify the contribution of each individual job satisfiers towards work commitment which is a novel approach and vital for the current business scenario.

Lots of research has paid more attention to other forms of commitment that includes organization, work cluster, employment, unification among workers and job (Cohen 1993). Cohen (1995) made an attempt to work on the limitations specified in the work done by Morrow (1993) and suggested that there exists variety of work commitment forms such as work involvement, occupational commitment and Protestant Work Ethic (PWE) apart from the more commonly used organization commitment and job involvement. Work commitment in many studies has been portrayed as an important predictor in work outcomes such as performance, organizational Citizenship behavior,

absenteeism and lethargy (Weiner, Vardi 1980). Since work commitment is related to several work outcomes it is imperative to explore this dimension as well in this study. A study by Lipinskiene (2008) found the relationship between job satisfaction and organizational commitment by formulating a question “May high job satisfaction be a reason of high organizational commitment?”. This study envisages the level of importance among the independent variables like the facets of job satisfaction towards work commitment. Conceptually, the goal of this research is to examine the individual job satisfiers towards work commitment using neural network among employees in a private organization.

With conventional algorithmic methods, learning complex relationships between input and output patterns would be very difficult and MLP has some advantage over conventional methods (Hwang 2001) and neural network is a much better tool than regression model in cross-validation multivariate correlations and correct classifications (Collins, Clark 1993). Practical problem-solving approaches in behavioral science using neural networks, particularly for behavioral prediction are wider in use (Scarborough, Somers 2006). A research by (Karanika-Murray, Cox 2010) suggested that R^2 Value for the variables worn-out and job satisfaction were highly significant in neural networks. A distinguishable feature of Neural Network lies in recognizing patterns in the collected data, and provides an essence of input data by filtering unrelated factors (Gupta, Sexton 1999). Neural networks have also been used in the organizations to identify the organizational improvement strategies which used genetic algorithm trained neural network which is a novel approach over standard statistical techniques (Montagno *et al.* 2002). A study to measure hotel employee's job satisfaction used neural networks to find the level of job satisfaction, and it is concluded that the professional development opportunities of employees and long-term growth aspects are most contributing variable for employee job satisfaction (Tian, Pu 2008). Neural network tools are more invaluable for exploratory and confirmatory research to better understand the human behavior in organizations (Scarborough, Somers 2006).

3. Research methodology

The primary data has been collected from one hundred employees through a closed-ended questionnaire. The Questionnaire consists of nine independent variables which are considered to be individual job satisfiers with 5-points Likert type scale. One refers to strongly disagree to the statement and 5 refer to strongly agree to the statement. The data collected for nine independent variables was re-coded with 1 = “strongly disagree”, 2 = “Disagree”, 3 = “Neutral” as 1 = “Dissatisfied” and 4 = “Agree”, 5 = “Strongly Agree” as 2 = “satisfied” for the purpose of analysis using neural networks.

The independent variables used in this study are individual job satisfiers which include pay, promotion, supervisor, benefits, rewards, operating procedure, co-workers, work itself and communication and the dependent variable is work commitment.

4. Data analysis and interpretation

4.1. Demographic characteristics of the employees

Hundred employees responded to the questionnaire with valid data. 34% of the employees are below 25 years, 37% of the employees are 26–35 years, 22% of the employees are 36–45 years and 7% of the employees are above 45 years. 77% of the employees are male candidate and remaining 23% of the employees are female candidate. Regarding composition of the place 34% of the employees belong to rural area and 56% of the employees are in urban area and 10% of the employees belong to semi-urban areas. Regarding designation 42% of the employees are working in finance and accounts department, 14% in service department, 8% of the employees are working in Operations department, 11% in T&D and 25% of the employees are in Human Resource department. Considering the experience, 58% of the employees are having experience below 5 years and 18% of the employees are having experience 6–11 years and 7% of the employees are having experience 11–16 years and 17% of the employees are having experience above 16 years. Descriptive analysis in the Table 1 revealed the details regarding the independent variables. The mean and standard deviation of job satisfiers (Pay, Promotion, Supervisor, Benefits, Rewards, Operating Procedure, Co-workers, Work itself, and Communication) are shown in Table 1.

The mean value ranges from 9.39 to 28.85, indicating that employees are satisfied and committed with all the dimensions. The standard deviation ranges from 0.47 and

Table 1. Descriptive statistics

S.NO	Individual Job Satisfiers	DISSATISFIED		SATISFIED	
		Mean	Std. deviation	Mean	Std. deviation
1.	Pay	9.39	2.79	16.3	0.47
2.	Promotion	9.38	2.84	16.35	0.48
3.	Supervisor	7.4	2.37	16.23	0.43
4.	Benefits	8.96	2.52	16.33	0.48
5.	Rewards	9.23	2.94	16.24	0.52
6.	Operating Procedure	9.24	2.63	16.46	0.78
7.	Co-workers	6.92	2.12	16.41	0.50
8.	Work itself	8.56	2.28	16.23	0.43
9.	Communication	7.30	2.14	16.38	0.51

4.90, indicating the high consistency of the data's variance level. This study exploits Job Satisfaction Tool developed by Spector (1985) which includes pay, promotion, supervision, benefits, rewards, operating procedures, co-workers, work-itself and communication. The study also uses work commitment tool based on Sue Hayday (2003) which includes seven statements to measure the employee's commitment level. The Chi-square test is computed to analyze the relationship between individual job satisfiers and work commitment of the employees and the results are given in Table 2.

Hypothesis: There is no significant relationship between individual job satisfiers and work commitment

Table 2. Chi-Square Test for individual job satisfiers and work commitment

	Chi-square	Sig.
Pay	12.042	.000
Promotion	10.082	.000
Supervisor	31.082	.001
Benefits	9.082	.000
Rewards	9.612	.000
Operating Procedure	7.612	.434
Co-workers	31.360	.000
Work itself	8.042	.838
Communication	30.042	.000
Work Commitment	35.042	.000

From the Table 2 it is concluded that there is significant relationship between individual job satisfiers (Pay, Promotion, Supervisor, Co-workers, Rewards, Benefits, and Communication) of the employees and work commitment. The result is supported by various studies by (Morrow, McElroy 1987; Moser 1997) and it is concluded that resultant work commitment of the employees is impacted by individual job satisfiers (Aydogdu, Asikgil 2011).

Table 2 displays chi-square result that tests the statistical evidence that there exists relationship between the individual job satisfiers and the dependent variable (Work Commitment (WC)). It shows that the probability of the Chi-square (35.042) is less than 0.05. Therefore, the null hypothesis stated that there is no relationship between the predicted variables (as listed in Table 2) and the dependent variable (WC) is rejected. Hence, it can be confirmed that there exists a relationship between individual job satisfiers and work commitment.

The level of employee perception towards work commitment due to the individual job satisfiers has been further

analyzed using MLP neural network method in the following tables.

The current study applies neural network as a predictive model in deciding the employee's perception towards job satisfiers. MLP Neural network model is used to predict the importance of individual job satisfiers towards work commitment with negligible error. The result derived from the model provides valuable source of information for future decisions in the organization. This prediction will offer hands to the top management to make crucial decisions about employees in recruitment, promotion, compensation, training, etc.

The Table 3 shows the classification of data of employee's as satisfied and dissatisfied.

Neural network model – multilayer Perceptron using SPSS has been used. SPSS tool choose the best architecture model automatically and it builds the network with one hidden layer. It is also possible to specify minimum (by default 1) and maximum (by default 50) number of units allowed in the hidden layer.

MLP neural network algorithm executes a neural network which is a composition of several layers of artificial neurons stimulated by input signals and is transmitted to the network through synapses to other neurons which are present in different layers.

The Figure 1 (Architecture of Applied Neural Network) which is given below represents artificial Perceptron neural model with 11 inputs $\{x_1, x_2, \dots, x_{11}\}$ in which each input x_i has an associated synapse w_i and an output y . The Neural network model which is displayed in Figure 1 states the relationship between job satisfiers and work commitment. The synaptic weight shows the strength of the relationship between variables.

During training process, a set of input data is repeatedly presented to the neural network and the output of the neural network is compared to the desired output and an error is also computed. This error is then back-propagated to the neural network in order to adjust the weight such that the error is also decreased and the neural model gets closer and closer to produce the desired output.

Table 3 shows the results obtained by neural networks with two, four, six and twelve hidden layers and it is

Table 3. Actual output and MLP predicted output by varying the size of hidden layer

Size of Hidden Layer	Correlation	Mean Absolute Deviation	Sum of Squares Error
2	0.81	4.63	30.898
4	0.93	3.29	30.319
6	0.94	3.18	29.509
12	0.94	3.13	23.715

concluded that the best neural network configuration is probably four hidden neurons, which has higher correlation and decreased error between actual output and MLP predicted output. The size of hidden layer influences the error on the nodes which is connected to the output layer. The stability of the neural network depends on the error. Excessive hidden neurons will cause over fitting and it generally degrades the generalization capability which leads to significant deviation in prediction (Jinchuan, Xinzhe 2008).

The model uses 70% of the data as training sample and 30% as testing sample to maintain the track of record about errors and to restrict over training.

4.2. Classification of satisfied and dissatisfied employees

Based on the neural network-SPSS 16, a predictive model was developed and the results are given in Table 4. The predictive model developed has excellent classification accuracy. In the Table 4 the neural network model is able to classify 37 satisfied employees as “Satisfied group” out of 42. Thus it holds 88.1% classification accuracy of employees for the “Good Group”. On the other hand, the same model is able to classify 4 dissatisfied employees as “Dissatisfied

Group” out of 22 dissatisfied employees. Thus, the model is able to generate 64.1% classification accuracy for both the groups – Satisfied and Dissatisfied employee group towards work commitment. The model used in this study uses only the training sample and not the testing sample.

Table 4. Predictive ability and classification results using Artificial Neural Network for satisfied and dissatisfied employees

Classification				
Sample	Observed	Predicted		
		Satisfied	Dissatisfied	Percent Correct
Training	Satisfied	37	5	88.1%
	Dissatisfied	18	4	18.2%
	Overall Percent	85.9%	14.1%	64.1%
Testing	Satisfied	14	5	73.7%
	Dissatisfied	11	6	35.3%
	Overall Percent	69.4%	30.6%	55.6%

Note: Dependent variable: Work Commitment.

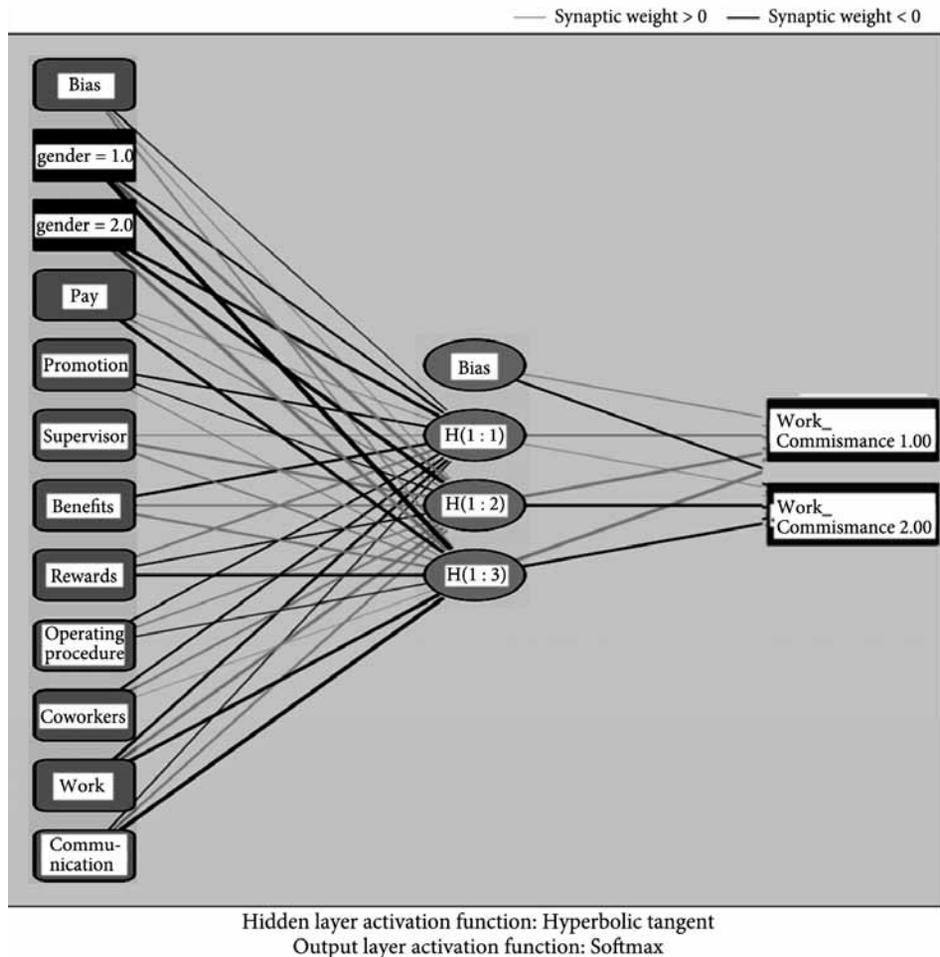


Fig. 1. Architecture of Applied Neural Network

SPSS MLP Neural network method has been used to examine the data collected by means of primary survey. MLP method consists of one hidden layer and the data has been classified as training and testing.

4.3. Predictive model summary based on neural network

Table 5. Model summary of dataset (job satisfaction and work commitment) using neural network

Training	Cross Entropy Error	26.668
	Percent Incorrect Predictions	35.9%
	Stopping Rule Used	1 consecutive step(s) with no decrease in error ^a
	Training Time	00:00:00.016
Testing	Cross Entropy Error	16.204
	Percent Incorrect Predictions	25.0%
Dependent Variable: Work Commitment		

Note: a. Error computations are based on the testing sample.

The above model summary in Table 5 infers the results of neural network training. Here the cross entropy error is displayed because the analysis is based on softmax activation function. During training process the neural network will minimize the error. In the current study the percentage of incorrect prediction is equal to 35.9% in the training sample. So the percentage of correct prediction is 64.1% which is an excellent prediction in a qualitative study for determining management results of job satisfiers towards work commitment. The predictive model of neural network is shown in Table 6.

Table 6. Predictive model of neural network

Model	Good – Satisfied group	Good – Dissatisfied group	Bad – Satisfied group	Bad – Dissatisfied group	Success Rate
Neural Network	37	5	18	4	64.1%

It is concluded that in management and social sciences where general conclusions are not possible, it is wise to use neural network where predictability is optimal.

Since MLP Predicted output is optimal with four hidden layers and is considered to be a good fit, the normalized importance of individual input parameters (Job satisfiers) which influence the output variable (work commitment) has been depicted in the following Table 7.

4.4. Independent variable importance

The Table 7 shows the importance of the individual input parameters (job satisfiers) which influence the output variable (work commitment) using neural network with four hidden layers. The input parameter- job satisfiers which cause satisfaction and dissatisfaction have been ranked by the neural network analysis are given below in Table 7.

Table 7. Independent variable importance generated based on neural network

Factors	Importance	Normalized Importance	Rank
Pay	0.127	59.8%	4
Promotion	0.114	53.6%	5
Superior	0.165	77.9%	2
Benefits	0.077	36.4%	7
Rewards	0.080	37.9%	6
Operating Procedure	0.014	6.7%	9
Coworkers	0.212	100.0%	1
Work itself	0.020	9.3%	8
Communication	0.142	66.9%	3

The importance of the independent variable (factor influencing work commitment) is a measure of how much the network model predicted value changes for different independent variable. The first three significant dominant factors that have been found are coworkers (100%), Superior satisfaction (77.9%) and communication (66.9%). The next two important factors have been pay, promotion. The factors rewards and benefits were at the same level. The other factors were relatively not important and the least important factor which was identified is Operating Procedure. A similar study by Parvin, Kabir (2011) found that compensation, relationship with co-worker, work efficiency and fringe benefits are the most influential factors in predicting job satisfaction. In a study by Zare Mehrjerdi and Aliheidary (2014) integrated intelligent algorithm was used to explore job satisfaction divulged that Pay, Work and Co-workers are the key factors in determining job satisfaction using Artificial Neural Network.

According to Friedlander and Margulies (1969), it was concluded that conducive relationship with employees will improve the level of job satisfaction. This shows that co-workers relationship plays an imperative role in the prediction of job satisfaction. A study by (Lee *et al.* 2011) found that the cordial relationship with the co-workers and the satisfaction with the work environment have a significantly positive relationship on job satisfaction. The results from a research by (Bernal *et al.* 2005) concluded that the relationship with employees, organizational conditions, personal achievement and economic aspects impacted the job satisfaction. The factor other than co-workers support that influence job satisfaction

includes communication from management, vacation time, professional development opportunities, job tasks, autonomy and independence etc. A study by Speers (2004) suggest that salary and benefits are termed as “hard” variables and these are less likely to influence job satisfaction than “soft” variables like coworkers relationship and communication.

Conclusions and scope for future research

The current study made significant contribution in predicting the level of work commitment through job satisfiers. This is imperative for the HR managers in predicting the work related outcome. The neural network model scrutinized the factors influencing work commitment as well as the job satisfier’s relative levels of importance. By eliminating unnecessary weights in the neural network model during the training process for the employee work commitment problem, Multilayer Perceptron neural networks using SPSS 16 worked exceedingly well. As a result a parsimonious Neural Network architecture was derived and has been used for testing datasets. The benefit in identifying the superfluous weights is the identification of inappropriate factors in the Neural Network model and tends to be a more efficient one. Overall, the Multilayer Perceptron performed well on predicting the result of work commitment problem and it is easier to use than the conventional Neural Network software available for behavioral researchers.

It is also concluded that in neural network analysis predictability is optimal in management decision making with least error by combinations of dependent and independent factors repeatedly.

The study has got several advantages for both academicians and business practitioners in decision making about employees. The study can be extended for a large sample of both public and private sectors. The study can also be further extended with the variables of personality, Emotional Intelligence and organizational climate. This study will be of great use in making crucial decisions in organization regarding recruitment, promotions, compensation like wage revisions etc. The study can also be extended with variables like Employee retention, Employee Engagement etc.

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