# Investigating Possibility of Predicting Turnover of Indian it Engineers Based on Quality of Work Life Using ANN

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*Abstract*

*The Indian IT sector witnesses a high annual turnover rate, with the increase in average annual attrition rate by 1% at the industry level for the year 2018. The figures also suggest that attrition is highest among medium and senior-level professionals, in tier 2 cities, especially in new technology areas. Although the firms have put in massive efforts like upskilling, reskilling, offering massive retention bonuses and offering client-facing roles, the attrition is still daunting many firms. Therefore, it is imperative to discern the root cause of attrition and it is plausible to view the same from multiple perspectives – considering both internal and external factors. One such prominent factor affecting turnover intention is Quality of work life, which has been analysed in this work. The focus of the work is to predict how the quality of work-life of middle-level engineers in Indian IT firms, affects and aids in predicting their turnover intention. The tool of analysis is Artificial Neural Networks.*

*Keywords: Quality of Work Life, Turnover, IT Engineers, Indian IT industry, Prediction, ANN*

## 1. Introduction

IT & ITeS sector in India is one of the major economic sectors, contributing 7.7 per cent to Indian GDP, as in the year 2019 [12] and the contribution is expected grow to 10 percent by 2025. Globally, India has been recognised as the leading sourcing destination for IT and ITeS services. As in 2017-18, the sourcing business from India in IT & ITeS sector, amounted to US$185-190 billion, approximating 55 percent market share [12]. Leading IT firms in the country are expanding in newer segments like blockchain, innovation hubs, artificial intelligence etc., attracting stronger demand globally in these new verticals. Around 75 percent of the global digital talent hails from India [12], but the sector is not without problems. It is an issue for the firms to retain this talent, because of the availability of global job opportunities, and low cost of hiring is a key point of attraction for hiring Indian talent. The statistics too affirm this gloomy state of affairs in the Indian IT sector, with the increase in average annual attrition rate by 1% at the industry level. The figures also suggest that attrition is highest among medium and senior-level professionals, in tier 2 cities, especially in new technology areas [1].

Although the firms have put in massive efforts like upskilling, reskilling, offering massive retention bonuses and offering client-facing roles, the attrition is still daunting many firms. Attrition is acceptable and considered healthy when the number is low, since it brings in fresh talent, with newer thoughts and ideas, it becomes regrettable when it poaches away key talent of the company such that their cost of replacement is high and their loss has an effect on business. Therefore, it is

imperative to discern the root cause of attrition and it is plausible to view the same from multiple perspectives – considering both internal and external factors. In this context, this work would focus on one such perspective, how the quality of work-life of middle-level engineers in Indian IT firms, affects and aids in predicting their turnover intention.

### 1.1 Objectives of the study
    **a.** To identify the dimensions of quality of work-life from the literature review
    **b.** To investigate the link between dimensions of quality and work-life and turnover intention for middle-level engineers using ANN
    **c.** To predict the turnover intention of middle-level engineers from their perception of the quality of work-life dimensions using ANN

## 2. Literature Review

The work-life interface has been a consistent topic of interest among researchers and organisations alike. Several factors like globalisation, trends in gender roles, families, works etc. have significantly shaped the work-life interface differently. Incorporating concepts like work-life balance and quality of work-life to study attrition among IT engineers is highly important since work-life interface in this sector is especially challenging [18]. This is because of the pressure on the employees by their employers and supervisors to devote maximum possible time on work, thereby decreasing 'quality time' [4]. At the same time, the advent of newer technologies and policies such as BYOD (bring your own device), Flexi-timings, work from home option have provided the liberty to employees to work at any time and from anywhere. But this has also blurred the line between work and home since individuals often perceive that they are tethered to their works even when they are at home owing to continuous contact through their devices [8] [9]. Additional pressure is created by boundary-less careers, when careers don't adhere to vertical mobility in the same firm and similar job roles [24]. Change in nature of family structures in the Indian context, too have contributed to the creation of work-life imbalance, since both the genders are juggling with multiple roles, both at work and home [10].

The concept of quality of work-life is defined as "Quality of work-life' (QOWL) refers to the favourableness or non-favourableness of a total job environment for the employees" – [20]. QOWL affects the job attitudes of the employees like organisational commitment, job satisfaction and so on, and through organisational interventions like conducting QOWL programs, jobs can be enriched, such that people admire working in those jobs, improving the overall health of the organisation. QOWL is related to many job outcomes like employee loyalty, employee job satisfaction, organisational commitment, employee engagement, each of which has significant effect on turnover intention of the employee [14] [17] [26].

Broadly, the concept of QOWL has two factors – work-related and life related [23]. The variables most significant in predicting QOWL are career-related variables like career satisfaction, career achievement and career balance, stress and burnout, work-life balance, etc [2]. Other factors predictive of QOWL are personal satisfaction, social satisfaction, mental satisfaction, work-related factors – enjoyment at work, motivation at work, achievement from work, other work-related miscellaneous factors, work involvement, nature of supervision, training and development, growth and job security, and occupation role in the organisation [19] [13] [30].

Leading firms continue to take initiatives to curb attrition, like digital training, extensive hiring, reducing project span [16] [22]. Firms opine that employees need quick mobility and such efforts like project transitions will provide the necessary rotation. Millennials too affirm that firms are not focusing on developing their

leadership skills, provide opportunities for career growth, chances to be in leadership position, opportunity for good work-life balance, adequate of firm's products and services, Flexi-timing and flexible locations for work and training and development programs for personal growth [7]. Another work [27] suggested that job responsibilities, followed by compensation, exert the greatest influence on employee turnover.

## 3. Research Methods

### 3.1 Sampling

The study population is comprised of middle-level engineers, who are working in Tier 1 IT companies of India, like Infosys, TCS, Wipro, and so on. The technique used for sampling was convenience sampling and snowball sampling. Initially, the contacts of the authors were reached for data collection, who was then asked to forward the same to at least 20 contacts of their working at this level in IT firms. A total of 212 respondents formed the final sample, who responded with complete responses.

### 3.2 Data collection

The items or the dimensions of the QOWL were elucidated from the literature review, as discussed in the previous section. A total of 12 dimensions were retained for the construction of the final questionnaire to conduct the survey. The dimensions used in the study for scale development were – personal satisfaction, social satisfaction, enjoyment at work, motivation at work, achievement from work, mental satisfaction, occupational role, work-related satisfaction, work involvement, nature of supervision, training and development, and growth and job security. Demographic variables included for analysis were gender, number of children, birth location, and marital status. The turnover intention has been measured using standard 3-item questionnaire and is labelled as 'Intention to quit'. This scale measures the intention of the individual to assess his tendency to stay with the organisation, within one-year of measurement [21]. All of the variables used in the study were measured on a five-point Likert scale. For each variable, the average score for its corresponding items was computed and used in final analysis in this work.

To establish the validity and reliability of the items used in the questionnaire, the questionnaire was initially administered to 30 engineers randomly for pilot testing. To assess reliability, Internal consistency approach has been applied, specifically the statistic 'Cronbach alpha' for each scale corresponding to each variable used in the work. This statistic can take values from 0 to 1, where for a given scale, value of Cronbach alpha less than 0.6 is considered unsatisfactory [15]. In this study, SPSS tool was used to determine Cronbach's alpha for each dimension of QOWL and intention to quit scale, and the values for each were deemed satisfactory (greater than 0.6). Only content validity was determined for each scale in this study by seeking a subjective evaluation from industry experts (software engineers at Infosys and TCS and HR managers) and academicians, to assess the applicability of the scale in the IT sector [29] [3].

### 3.3 Data Analysis

For data analysis, ANN or Artificial Neural Networks were utilised. ANN is a mimic of the human brain and the same processing of a biological neural network is modelled using ANN. An artificial neural network has broadly three layers termed as the input layer, the hidden layer and the output or response variables layer. All the independent variables or covariates of the study comprise the input layer. All the dependent or outcome variables form the output layer. The hidden layer can contain

more than one sub-layer, and it contributes to the black box nature of the ANN technique. Typically, functioning of ANN involves computation of weighted sum of inputs, where weights are randomly assigned by the ANN algorithm specified in the software. This weighted sum is compared with actual output values (supervised learning technique) and then the difference of the two is used to adjust the weights to generate accurate output and minimise error. The central target of ANN algorithm is to minimise RMS (root mean squared error). When minimum value of RMS is reached, the iterations of the algorithm stop.

It is seen that in the final iteration of the algorithm, the weights assigned to inputs indicate their contribution towards output, such that higher the weight of an input node, higher would be its contribution towards the output. This technique is called supervised learning, since observed values of output nodes are used to correct weights of the algorithm, a form of supervision. There are several models of ANN in use, to compute the weighted average, and least error value and the number of iterations are pre-decided as per each model. The most widely used model is multilayer perceptron, which is also in use in ANN in SQL Server 2012. Multilayer perceptron [31] is like a directed graph which has nodes and directed edges.

The ANN model used in this work can be mathematically described [28] as follows: initially, weights were randomly assigned to the inputs and weighted sum was computed as output. Then error function which is the different between calculated output and observed (actual) value of the output is computed. Thereafter, through application of chain rule, the partial derivative of this error function is calculated. Then a negative gradient descent method allows the error function to drop through gradual adjustments in weight. This whole process is repeated for each item in the training dataset which consists of a set of inputs and outputs. The process stops when pre-specified number of iterations is reached or minimum error value is reached. This implies that algorithm has learnt the patterns in the data and can be used for future predictions. The structure of the neural network model used in this study is as shown in figure 1.
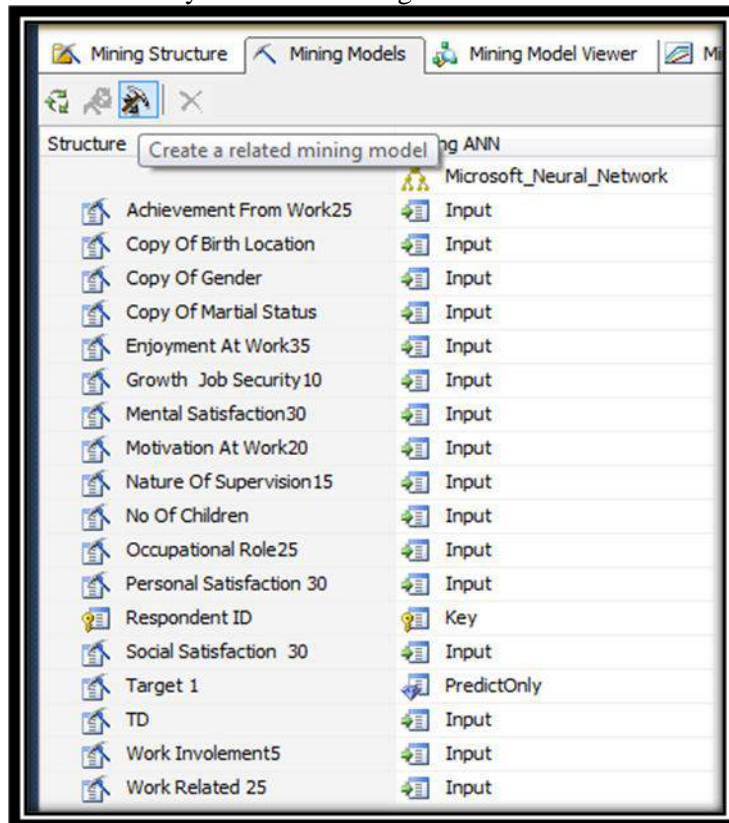


**Figure 1. Structure of the ANN mining model used in the study**

The output of the mining model in SQL Server 2012 has to be interpreted using the two mining output views offered by this platform. One view is called as Microsoft Generic Content Viewer and the other is termed as Mining Model viewer. While the former describes the technical aspects of the model, and requires slight engineering background for interpretation, the latter offers much valuable insight for the researcher. This view of the platform depicts key influencers for pre-selected value of output variables. The key influencers are the values of the input attributes which significantly affect the given state of the target or output variable. For this work, the view will fetch the dimensions of QOWL which significantly affect the turnover intention of middle level engineers. To interpret the output state, the values of turnover intention are coded as '0' for those who have the intention to stay and '1' for those who have the intention to quit the firm.

## 4. Results & Discussion

The results have been depicted below for each target state. The figure depicts the key influencers for each target state. The key influencers of QOWL on the turnover intention for those who have the intention to stay and leave have been depicted in Figure 2, where target state 1, favouring the value 0 implies those who have the intention to stay and vice versa.
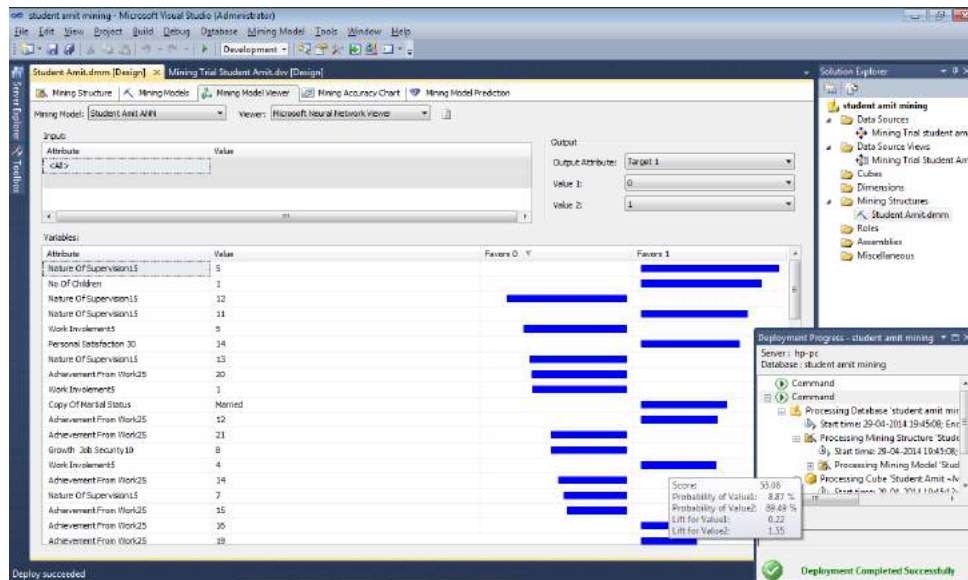


**Figure 2. Key Influencers for Intention to Stay and Leave**

ANN fetches key influencers for each state and also attaches probability with the same. As depicted in the figure, Key influencers for those who tend to stay (target 1 state has value 0) as predicted by ANN from a sample of 212 respondents:

- Nature of supervision has a high score (12 or more score out of 15) – more than 92% probability to stay
- Work involvement is high (5 on 5 scores) – more than 89% probability to stay
- Achievement from work is high (more than 20 out of 25 scores) – 88% probability to stay
- Those who believe growth and job security is high in the current job have very high chances of staying (more than 82%)

The above findings are consistent with literature which suggests that the quality of work-life affects the turnover intention of the individuals. When middle-level engineers perceive that they receive appropriate support from supervisors,

have tasks which keep them highly involved, receive sufficient appreciation and recognition for the work that they do, and also believe that the organisation is offering them high growth opportunities along with security in the current position, have a low turnover intention and high tendency to stay. For those who tend to leave the firm (target 1 has value 1), the key influencers are:

- Nature of supervision is low or medium (5 or below 12 scores out of 15) – more than 96% chances to leave
- Have one or more children - the probability to leave is 95%
- Personal satisfaction is average – more than 93% chances to leave
- Married have more than 91% chances to leave
- Achievement from work is low or average

Similarly, for those to leave perceive supervisor support is minimal, and do not attach much importance to the work, such that perception of achievement from work is low. Such individuals have also been seen to be personally not much satisfied. An interesting revelation is that they are married and have one or more children. Probably work-life imbalance affects their quality of work-life to such an extent, that their job outcomes are affected. Adding to the robustness of the analysis, key influencers for target state 2 which determines the intention of the particular candidate to leave are also identified. From this perspective, the key influencers for 0 state which is that the candidate has no intention in the future to leave the firm:

- Achievement from work and work-related satisfaction is high
- Married status
- High work involvement
- Closed nature of supervision
- High growth and job security in the current firm

Such respondents show more than 75% probability to stay with the firm.

### 4.1 Predictive scenarios

Based on the above-identified key influencers for each state, prediction can be done. The above modelling to establish the link between dimensions of QOWL and turnover intention can be used for prediction of the same for different input values.

**What if the candidate is from an urban location?**

Use singleton query where the birth location is set to urban (ANN fetches the target state based on past learning from the data) and corresponding target state is shown:
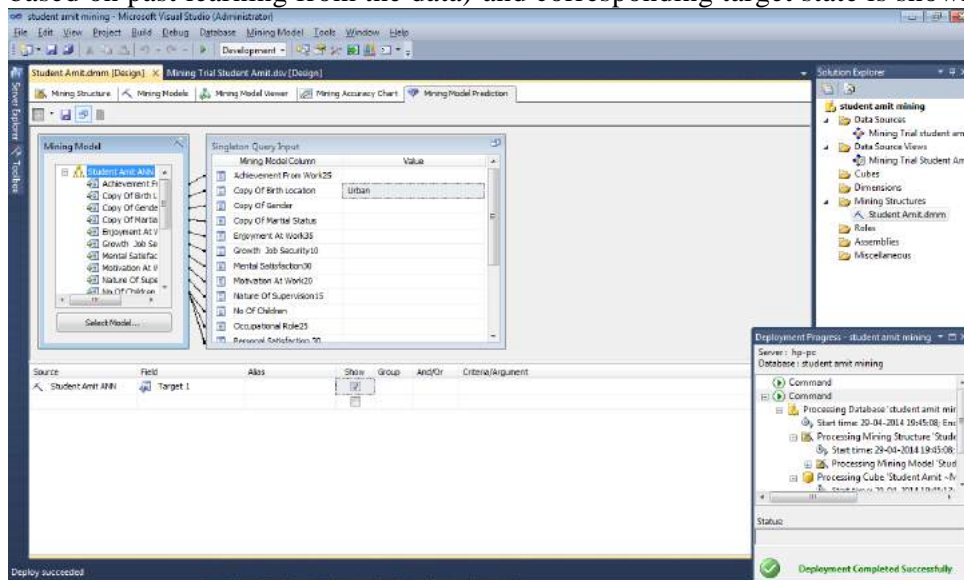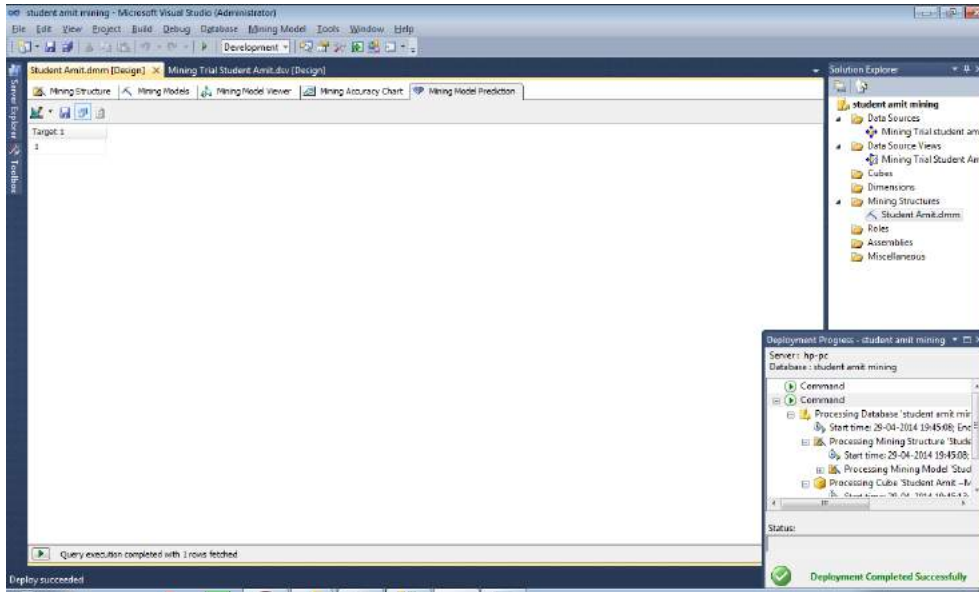


**Figure 3. Query 1**

**Figure 4. Query 1 Output**

1. **What if the candidate is from a rural location, is married and gives a high score on T&D?**
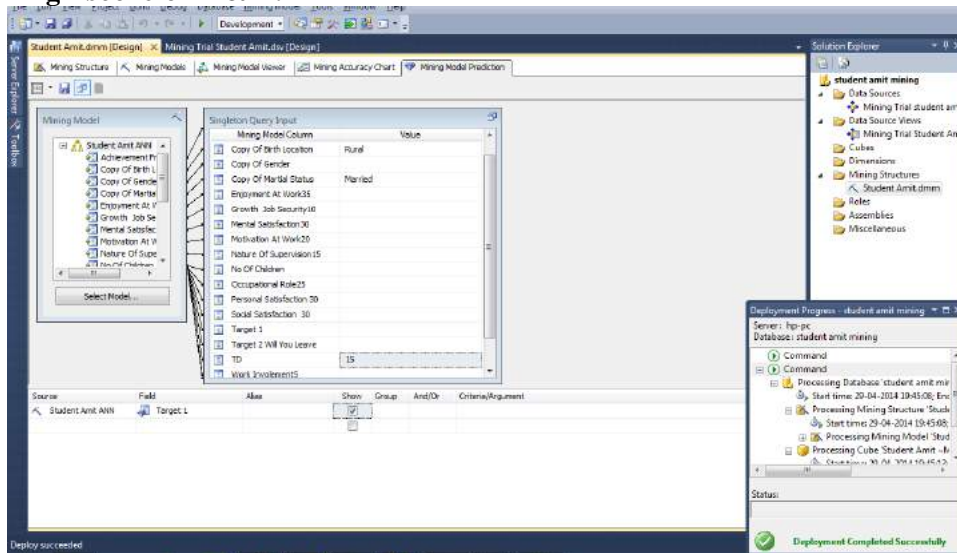


**Figure 5. Query 2**

The result shows that the target state is 1, implying that although candidate rates the current firm high on its imparting training and development, yet the person is bound to leave.

2. If a candidate is married and from a rural location, but believes that nature of supervision is high (input 13), achievement from work is high (17), and work involvement is high (5), what are the chances of staying?
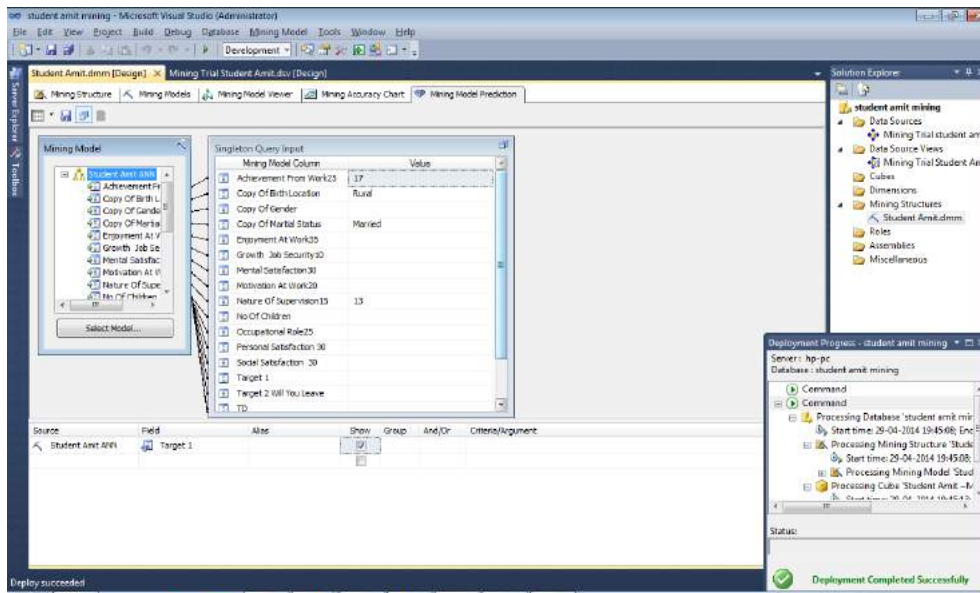
**Figure 6. Query 3**

Result fetched by SQL predictive query is target state 0, implying that candidate is highly likely to stay with the firm.

## 5. Practical Implications and Future Scope

The results demonstrate that there is a link between QOWL and turnover intention of middle-level engineers in tier 1 IT firms. Using ANN, a predictive model can be developed which will learn from the past or training data, and then predict turnover intention based on input values. Such a model can aid the organisation in proactive managing turnover. Also, the results show that employees do not want to leave the firm when they perceive QOWL based on work-related factors is high. Majority of the factors that emerged from the analysis were work-related such as achievement from work, work involvement, work satisfaction, career growth opportunities and job security. All of these were linked with high intention to stay in the firm. A few personal QOWL factors emerged which were being married and personal satisfaction, however, their impact is minimal. Therefore, to retain the employees, firms should strategise around work-related factors – offering meaningful work, job rotation, job enrichment are some of the techniques that can be applied to enhance the satisfaction derived by middle-level engineers from work.

QOWL is just one limited perspective. Many other factors and mediating and moderating variables can be included in an analysis like the effect of job outcomes on QOWL and then studying the effect on turnover intention. Concepts like work-life balance, employee well-being, employee engagement are some other constructs which have an impact on QOWL and therefore, turnover intention. All of these can be included in the future scope. Besides this, ANN works best when the dataset is very large. Therefore, the sample size can be increased to add to the robustness of the study. Further limitations emerged from the use of a self-report questionnaire, which included self-report bias in the study. Further, QOWL varies with cultural variations as well, mainly affecting the personal factors of the construct. Since IT firms operate at a multinational level, a cross-cultural study can also be conducted.

An additional limitation is posed by the characteristics and limitations of the tool used for analysis. The ANN mining model in MS SQL Server 2012 [25] allows limited possibilities of customising the parameters of the model. The customisable attributes are – restriction on maximum number of input and output attributes to be used in given model, where the default maximum value is 255; number of hidden

nodes can be supplied as a ratio, such that the product of this ratio and the square root of the product of input and output neurons is used as number of hidden nodes in hidden layer. By default, this value is set at 4.

**Conclusion**

IT & ITeS sector in India is one of the major economic sectors, contributing 7.7 percent to Indian GDP, as in the year 2019 [12] and the contribution is expected grow to 10 percent by 2025. The turnover rates in IT firms is very high, with attrition being highest among medium and senior-level professionals, in tier 2 cities, especially in new technology areas [1]. Although the firms have put in massive efforts like upskilling, reskilling, offering massive retention bonuses and offering client-facing roles, the attrition is still daunting many firms. Therefore, it is imperative to discern the root cause of attrition and it is plausible to view the same from multiple perspectives – considering both internal and external factors. In this context, this work would focus on one such perspective, how the quality of work-life of middle-level engineers in Indian IT firms, affects and aids in predicting their turnover intention.

The study population consisted of middle-level engineers working in Tier 1 IT firms in India. A total of 212 responses were collected using convenience and snowball sampling. The items or the dimensions of the QOWL were elucidated from the literature review, as discussed in the previous section. A total of 12 dimensions were retained for the construction of the final questionnaire to conduct the survey. The dimensions used in the study for scale development were – personal satisfaction, social satisfaction, enjoyment at work, motivation at work, achievement from work, mental satisfaction, occupational role, work-related satisfaction, work involvement, nature of supervision, training and development, and growth and job security. Demographic variables included for analysis were gender, number of children, birth location, and marital status. The turnover intention has been measured using standard 3-item questionnaire. Cronbach alpha and content validity were used to assess the reliability and validity of the questionnaire.

For data analysis, ANN or Artificial Neural Networks were utilised. The tool used for analysis was SQL Server 2012. It will fetch the key influencer for each target state, that is the turnover intention. The coding for turnover intention is as follows – '0' for those who have the intention to stay in the firm, while '1' for those who have the intention to quit. the results demonstrate that there is a link between QOWL and turnover intention of middle-level engineers in tier 1 IT firms. Using ANN, a predictive model can be developed which will learn from the past or training data, and then predict turnover intention based on input values. Such a model can aid the organisation in proactive managing turnover. Also, the results show that employees do not want to leave the firm when they perceive QOWL based on work-related factors is high. Majority of the factors that emerged from the analysis were work-related such as achievement from work, work involvement, work satisfaction, career growth opportunities and job security. All of these were linked with high intention to stay in the firm. A few personal QOWL factors emerged which were being married and personal satisfaction, however, their impact is minimal. Therefore, to retain the employees, firms should strategise around work-related factors – offering meaningful work, job rotation, job enrichment are some of the techniques that can be applied to enhance the satisfaction derived by middle-level engineers from work.

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