CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter describes the research methodology which includes the process of data collection and analysis. This study explores the influencing factors for migration and the expected retention factors for civil engineers working in the construction industry. To ensure the accuracy of results it is therefore important to choose an appropriate research methodology.

3.2 RESEARCH METHODOLOGY

The various tasks involved in this research work are listed below.

- Review of literature.
- Extraction of critical factors related to migration and retention of engineers in construction industry.
- Preparation of Survey questionnaire.
- Distribution of questionnaire to civil engineers working in construction industry.
• Collection of data from the respondents using random survey method.

• Data Analysis using SPSS (statistical package for the social sciences).

• Interpretation of results.

• Establishment of equation for estimating migration / retention indices using discriminant analysis.

• Development of utility equation for estimating the probability of migration / retention of engineers in construction industry using logistic regression analysis.

The statistical analysis is the most powerful tool for taking appropriate decisions, and hence it is adopted in this research. The various steps involved in the project are shown in Figure 3.1.
Identification of the research problem

Review of literature

Questionnaire preparation

Data Collection
- Interviewing civil engineers regarding
  - Respondents’ profile
  - Whether or not intending for migration from current employment
  - Reason for migration
  - Factors for promoting retention

Identifying the influencing factors on migration and retention (individually and group)

Creating groups under six heads using migration and retention factors
1. Personal factor
2. Work environment
3. Leadership and superior
4. Job satisfaction
5. Growth prospects
6. Awards, recognition and facility management

Measuring the influence of respondents’ profile on each group

Measuring the influence of respondents’ profile on migration and retention factors

Estimating the migration / retention indices using discriminant analysis

Developing utility equation for estimating the probability of migration / retention of engineers, using the logistic regression analysis

Findings and conclusions

Figure 3.1 Research methodology
3.2.1 Survey Questionnaire Preparation

A questionnaire is essentially a structured technique for collecting data. It is generally a series of written questions for which the respondent has to provide the answers.

If a questionnaire is well designed, it will motivate the respondents to give accurate and complete information. As such, it should provide reliable and relevant data in return. Usually, a questionnaire consists of a number of questions that the respondent has to answer in a set format.

Questionnaires have advantages over some other types of surveys in that they are cheap, do not require as much effort from the questioner as verbal or telephone surveys, and often have standardized answers that make it simple to compile data. Questionnaires are also sharply limited by the fact that respondents must be able to read the questions and respond to them.

A questionnaire in this context was prepared and is shown in Appendix 1 “Study on factors influencing the Migration of engineers in the Construction Industry: Engineers’/Supervisors’/Foremen’s views”.

3.2.3 Instrument and Measures

The survey questionnaire contains three parts A, B and C. Part A (Appendix 1) is the personal profile that records personal details like: name (optional), designation, age, gender, educational qualification and socio economic details like the marital status, size of the family, place of stay, and data to decipher work patterns like the experience in an industry, and the total number of years of experience in the field of construction industry.
Part B, titled reason for migration of civil engineers in construction industry seeks responses on a five point Likert scale, very low, low, moderate, high, and very high, for reasons addressing several factors in Appendix 1.

Similarly, Part C is the assessment of the critical factors for the retention of engineers in a company, and is given in Appendix 1.

3.3 COLLECTION OF DATA

3.3.1 Sample Size and Sampling Technique

This survey is based on a sample size of five hundred, out of which three hundred and twenty two respondents. The respondents were divided into four categories namely i. Drawing and Design Engineers, ii. Planning Engineers, iii. Site Engineers, iv. Site Managers. Twenty five percent of questionnaire was distributed to each category. It is conducted among engineers working in various construction organizations in the metropolitan city of Chennai in the state of Tamilnadu, India through questionnaire survey. The study adopted the systematic random sampling technique. The justification for this technique is based on the fact that it enables every subject in the sampling frame to have equal opportunity to be selected without bias in a systematic manner (Ogbeide 1997).

The survey was self administered and distributed between five hundred engineers working in various construction organizations in the metropolitan city of Chennai in the state of Tamilnadu, India. Initially the questionnaire was distributed to the respondents and proposed to be collected later. However before handing over the questionnaires, all the questions were explained to every respondent so that they could fill the questionnaire easily and properly. The responses were collected and analyzed. Out of 500 copies of questionnaire administered to respondents, 322 were retrieved and analyzed.
3.4 DATA ANALYSIS

The data were collected from three hundred and twenty two respondents, through a survey questionnaire pertaining to forty factors under two categories, viz.: (i) Reason for Migration and (ii) Factors for promoting retention.

After data collection, it was analyzed using SPSS (Statistical Package for the Social Sciences), a software used for statistical analysis. It can take data from almost any type of file and use them to generate tabulated reports, charts and plots of distributions and trends, descriptive statistics, and complex statistical analyses. The details of analysis are explained below.

3.4.1 Respondents’ Profile

The respondents’ profile of the sample like gender, education, marital status, designation, place of stay and other details of the respondents are explained, using descriptive statistics in Chapter 4. The minimum, maximum, mean and standard deviations of some of the work-life related parameters are discussed.

3.4.2 Migration and Retention Factors

The Kolmogorov-Smirnov test for checking the normalcy of the distribution of the scores of the migration and retention factor was done, so that it could be decided whether to run parametric or non-parametric tests. The various significance tests were carried out for finding the significance of the respondents profile on migration and retention factors.

The F-test or t-test, whichever was applicable, was used for different significance tests of the migration and retention factors.

This was followed by the paired sample t-test on the data to see the relationship between migration and retention scores. The test was conducted
initially on the entire data set and later continued with subsets of the data set, based on some split criteria like gender, education etc.

A correlation of the migration and retention factor score and other continuous data type demographic details was obtained, and is presented.

3.4.3 Factor grouped under six heads – A different perspective

Nineteen out of forty factors are identified as the cause of migration and the remaining twenty one factors are identified as the factors promoting retention. These forty factors were further grouped under six heads (independent variables), namely,

1. Personal
2. Work Environment
3. Leadership or Superiors
4. Job satisfaction
5. Growth Prospects
6. Awards, Recognition and Facility Management

Each of the forty factors identified as critical factors influencing migration and retention of engineers in construction industry is given a factor number. The factors having factor number 1 to 19 are the factors influencing migration (M) and the factors having factor number 20 to 40 are the factors promoting retention (R) of engineers.

The analysis was continued by looking at the data from a different perspective. The forty factors influencing migration / retention are grouped under six groups namely personal, work environment, leadership and superiors, job satisfaction, Growth Prospects, and awards/recognition and facility management and are presented in Table 3.1.
### Table 3.1 Critical factors influencing migration and retention of engineers

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Factor No.</th>
<th>Migration (M) or Retention(R)</th>
<th>Critical Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td><strong>Group 1: Personal</strong></td>
</tr>
<tr>
<td>1</td>
<td>F1</td>
<td>M</td>
<td>Not satisfied with the salary package offered by the company or moving to a better paying job.</td>
</tr>
<tr>
<td>2</td>
<td>F2</td>
<td>M</td>
<td>Individual liking for career changes</td>
</tr>
<tr>
<td>3</td>
<td>F4</td>
<td>M</td>
<td>Problems of family and spouse’s relocation</td>
</tr>
<tr>
<td>4</td>
<td>F5</td>
<td>M</td>
<td>Less time to spend with family or less vacation</td>
</tr>
<tr>
<td>5</td>
<td>F8</td>
<td>M</td>
<td>Stress due to overwork</td>
</tr>
<tr>
<td>6</td>
<td>F20</td>
<td>R</td>
<td>Fair and competitive salaries offered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R</td>
<td><strong>Group 2. Work Environment</strong></td>
</tr>
<tr>
<td>7</td>
<td>F3</td>
<td>M</td>
<td>Distance from place of stay</td>
</tr>
<tr>
<td>8</td>
<td>F7</td>
<td>M</td>
<td>Idle most of the time</td>
</tr>
<tr>
<td>9</td>
<td>F9</td>
<td>M</td>
<td>Working overtime regularly</td>
</tr>
<tr>
<td>10</td>
<td>F10</td>
<td>M</td>
<td>No adequate safety measures</td>
</tr>
<tr>
<td>11</td>
<td>F12</td>
<td>M</td>
<td>Not satisfied with interpersonal relationships with coworkers</td>
</tr>
<tr>
<td>12</td>
<td>F28</td>
<td>R</td>
<td>Flexible with working time</td>
</tr>
<tr>
<td>13</td>
<td>F30</td>
<td>R</td>
<td>The best tools and equipment available in the workplace</td>
</tr>
<tr>
<td>14</td>
<td>F32</td>
<td>R</td>
<td>Positive work environment (Relationships, values and culture.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R</td>
<td><strong>Group 3. Leadership and Superiors</strong></td>
</tr>
<tr>
<td>15</td>
<td>F13</td>
<td>M</td>
<td>No honest and worthy leaders or loss of confidence with senior leader.</td>
</tr>
<tr>
<td>16</td>
<td>F14</td>
<td>M</td>
<td>No encouragement by leaders</td>
</tr>
<tr>
<td>17</td>
<td>F25</td>
<td>R</td>
<td>Varied assignments provided on engineers talent</td>
</tr>
<tr>
<td>18</td>
<td>F27</td>
<td>R</td>
<td>Chance of communicating openly with superiors</td>
</tr>
<tr>
<td>19</td>
<td>F33</td>
<td>R</td>
<td>Distribution of workload uniformly</td>
</tr>
<tr>
<td>20</td>
<td>F38</td>
<td>R</td>
<td>Friendly, accessible, honest and trustworthy leaders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R</td>
<td><strong>Group 4: Job Satisfaction</strong></td>
</tr>
<tr>
<td>21</td>
<td>F6</td>
<td>M</td>
<td>Feeling less valued and no recognition</td>
</tr>
<tr>
<td>22</td>
<td>F11</td>
<td>M</td>
<td>No freedom for innovative thinking in job</td>
</tr>
<tr>
<td>23</td>
<td>F15</td>
<td>M</td>
<td>No regular job rotation and new assignments</td>
</tr>
<tr>
<td>24</td>
<td>F23</td>
<td>R</td>
<td>Clear definition of roles and responsibilities for engineers.</td>
</tr>
</tbody>
</table>
Table 3.1 (Continued)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Factor No.</th>
<th>Migration (M) or Retention(R)</th>
<th>Critical Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>F16</td>
<td>M</td>
<td>Less growth and advancement opportunities available in company</td>
</tr>
<tr>
<td>27</td>
<td>F17</td>
<td>M</td>
<td>Promotion is not based on performance and not offering performance bonus or incentives</td>
</tr>
<tr>
<td>28</td>
<td>F18</td>
<td>M</td>
<td>Provision of health facilities not available in the company</td>
</tr>
<tr>
<td>29</td>
<td>F19</td>
<td>M</td>
<td>No training programme in the company</td>
</tr>
<tr>
<td>30</td>
<td>F21</td>
<td>R</td>
<td>Corporate image</td>
</tr>
<tr>
<td>31</td>
<td>F22</td>
<td>R</td>
<td>Adequate advancement opportunities provided (Regular performance reviews conducted to identify employees’ strengths and weaknesses)</td>
</tr>
<tr>
<td>32</td>
<td>F24</td>
<td>R</td>
<td>Employees’ satisfaction surveys conducted</td>
</tr>
<tr>
<td>33</td>
<td>F35</td>
<td>R</td>
<td>Grievances addressed and redressed</td>
</tr>
<tr>
<td>34</td>
<td>F26</td>
<td>R</td>
<td>Recognition and display of achievement statement for each project</td>
</tr>
<tr>
<td>35</td>
<td>F29</td>
<td>R</td>
<td>Effective orientation program provided</td>
</tr>
<tr>
<td>36</td>
<td>F31</td>
<td>R</td>
<td>Employees to be recognized properly (Recognize outstanding achievements promptly and publicly)</td>
</tr>
<tr>
<td>37</td>
<td>F34</td>
<td>R</td>
<td>Recreation (picnic, sports, cultural activities) to be provided</td>
</tr>
<tr>
<td>38</td>
<td>F36</td>
<td>R</td>
<td>Provision for free medical treatment with salary during sick periods</td>
</tr>
<tr>
<td>39</td>
<td>F37</td>
<td>R</td>
<td>Provision for education and training opportunities</td>
</tr>
<tr>
<td>40</td>
<td>F40</td>
<td>R</td>
<td>Employee/children’s day care facilities available</td>
</tr>
</tbody>
</table>

The minimum, maximum, mean and standard deviations of these six groups were calculated. The influence of each of the respondents’ profile details like education, gender, place of stay, marital status, etc., on all the six groups of influencing factors were analysed.
3.4.4 Response of Intention towards Migration in Current Employment

The relation between the respondents’ profile and the response to the question, whether he/she would continue in the organization, was critically analysed. Since the parameters were categorized in nature, cross tabulation and chi square tests were done to find these associations.

3.4.5 Discrimination of the Influencing Factor

The discriminant analysis is a very useful tool for detecting the variables, which allow discriminating between different (naturally occurring) groups, and for classifying cases into different groups with a better chance of accuracy. In this study, the discriminant analysis was carried out to discriminate between two groups of engineers, (i) engineers who stay in the company and (ii) engineers who intend to migrate from the company.

The discriminant or discriminant function analysis is a parametric technique, which determines the weight of the quantitative variables or predictors, which can be used to discriminate between two or more than two groups of cases. The analysis creates a discriminant function, which is a linear combination of the weightings and scores of these variables. The maximum number of functions is the smaller value of the following (i) the number of predictors and (ii) the number of groups minus one (Ramayah et al 2010).

\[ Z_{jk} = a + W_1X_{1k} + W_2X_{2k} + ... + W_nX_{nk} \] (3.1)

where

- \( Z_{jk} \) = Discriminant Z score of the discriminant function \( j \) for object \( k \).
- \( a \) = Intercept.
- \( W_i \) = Discriminant coefficient of the Independent variable \( i \).
- \( X_j \) = Independent variable \( i \) for object \( k \).
Cutting Score

In a two group discriminant function, the cutting score will be used to classify the two groups uniquely. The cutting score is the score used for constructing the classification matrix. The optimal cutting score depends on the size of the groups. The formulae for calculating optimal cutting score are presented in Equation (3.2) and (3.3).

Figure 3.3 Cutting score

Unequal group

\[ Z_{cs} = \frac{N_A Z_B + N_B Z_A}{N_A + N_B} \]  

(3.2)

where \( Z_{CS} \) = Optimal cutting score between group A and B.

\( N_A \) = Number of observations in group A.

\( N_B \) = Number of observations in group B.

\( Z_A \) = Centroid for Group A.

\( Z_B \) = Centroid for Group B.

Equal group

\[ Z_{ce} = \frac{Z_A + Z_B}{2} \]  

(3.3)

where \( Z_{CE} \) = Optimal cutting score for equal group size.

\( Z_A \) = Centroid for Group A.
\[ Z_B = \text{Centroid for Group B}. \]

Since there were two distinct group of respondents, based on whether they were willing to stay back in the organization or would prefer to leave, the study went on to find out whether the six groups that were created earlier, and other demographic details like gender, education, etc., could clearly discriminate between these two groups. The discriminant analysis could then be used to determine which variable(s) are the best predictors of the engineers’ subsequent migration.

### 3.4.6 Discrete Choice Model for Estimation of the Migration Probability

A multinomial logistic model is the extension of the binary logistic model. When the categorical dependent outcome has more than two levels, linear regression is not appropriate for situations in which there is no natural ordering of the values of the dependent variable. In such cases, the multinomial logistic model may be the best alternative.

The objective of the Multinomial Logistic (MNL) model is to estimate a function that determines the outcome probabilities. This study is to find out the probability of anyone staying on or leaving the organization, based on those demographic details, which had a significant relationship with the outcome variable. Unlike the discriminant analysis, in this analysis only demographic details were included, and the six groups created based on the responses to the migration and retention questions, were not used.

Multinomial logistic regression is used for a dependent variable with unordered categories. One category is chosen as the reference category, typically the first, the last or the value with the lowest or highest frequency. The probability of each category is compared with the probability of the reference category. For categories \( i = 2, \ldots, K \), the probability of each category is as follows (Borooah 2001)
\[
\Pr(y = i) = \frac{\exp(z_i)}{1 + \sum_{n=2}^{k} \exp(z_{in})}
\]  
(3.4)

where \( \alpha_i + \sum_{h=1}^{H} \beta_{ih} x_{ih} = z_i \)

\( \alpha_i \) = cut point of categories

\( H \) = categories of dependent variables

For the reference category,

\[
\Pr(y = 1) = \frac{1}{1 + \sum_{n=2}^{k} \exp(z_{1n})}
\]  
(3.5)

After rearranging Equations (3.4) and (3.5), the MNL model can be written as follows:

\[
L_{hi} \left[ \frac{P(y = i)}{P(y = 1)} \right] = \alpha_i \sum_{h=1}^{H} \beta_{ih} x_{ih} = Z_i
\]  
(3.6)

where \( i \) : the number categories

\( \beta_{ih}, x_{ih} \) : Vectors of the estimated parameters and predictors variables respectively

\[
\left[ \frac{P(y = i)}{P(y = 1)} \right] \quad \text{The probability of the first category as reference}
\]

The probability of a retention or migration is restricted to lie between zero and one.

### 3.5 SUMMARY

This chapter gives a brief sketch of the different steps in the study process, namely, problem definition, review of earlier studies, identification of the study process, data collection, data analysis, and reporting the findings.