CHAPTER 3

RESEARCH METHODOLOGY

The theoretical perspectives and the review of relevant literature in the first and second chapters led to the objectives and hypotheses developed in this chapter, forming the basis for the formulation of the research methodology for this investigation. The major purpose of this study is to capture the prevalence of motivation among Defence Officers and employees in Industrial Organizations.

The researcher has presented and interpreted the collected data supported by quantitative techniques. In the subsequent sections, the researcher elaborates the method adopted to design and administer the questionnaire and the sampling technique used.

3.1 NEED AND SCOPE OF THE PRESENT STUDY

Most of the western motivation theories are not working properly / not fully applicable for Indian organizations, which is evident from various case studies. There is a need to see Japanese way of Management also. Japan liberalized its economy in 1867, but didn’t allow its cultural invasion. Therefore, it was in position to take hierarchy over USA during Second World War. During and after Second World War, hierarchy and motivation were at their peak in Japan, making its progression quite visible. In the corporate sector in India, we follow US Management, without understanding their cultural differences (deal-first culture). Financial motivators work most in life stages when attraction is need-based (in western thought); but not in later stages when attraction is relation-based (in eastern thought). Therefore, most of the western theories are not working properly in Indian context.

Motivation, being a universal phenomenon, is not just restricted to the corporate sector, but also the organizations like armed forces, etc. Lot of things (concepts) have been borrowed from the armed forces since past. Unfortunately, business world has been working as a tangent with other organizations; that is why it is not being able to utilize motivation concept fully.
Through perusal of existing literature on Motivation, it has been revealed that although there has been a lot of research on motivation of managers abroad, yet there is a dearth of research of motivation in Indian context in general. This topic gains importance in view of the various environmental changes that have occurred all over the world. In the present times, the role of managers as motivational leaders has become indispensable for the growth of an organization. The various studies on motivation suggest that motivation levels of managers and officers get significantly affected by a lot of variables relating to followers and organization as a whole, e.g. leadership behaviour, organizational culture, team spirit, personal effectiveness, etc.

Hence, there is a need to amalgamate (relationship-based) Indian thought with (deal-based) western thought and evolve an integrated motivation model applicable in India, so as to study motivation with holistic approach and not with lateral or linear view. For this kind of motivation, enlightened leadership is required, which will be studied simultaneously.

3.2 Statement of the Problem

Motivation in Indian Context : An Amalgamation of Eastern and Western Thought.

3.3. Objectives of the Study

The objectives of the research study are as under:

1. To evaluate the applicability of some important western theories in Indian organizations.
2. To evaluate the extent to which leadership behaviour affects employee motivation.
3. To explore the impact of financial and non-financial motivators on employee motivation.
4. To determine the relation between Motivation and personal effectiveness.
5. To evolve an integrated motivation model applicable in Indian business organizations.
6. To compare the motivational pattern in Defence and Industrial organizations.
3.4. Hypotheses of the Study

Following are the alternate hypotheses generated from the objectives of the study:

\(H_1\) : Some of the western motivation theories are not applicable for Indian organizations.

\(H_2\) : Leadership behaviour affects employee motivation.

\(H_3\) : Financial and non-financial motivators have direct impact on employee motivation.

\(H_4\) : There is a relation between Motivation and personal effectiveness.

\(H_5\) : Motivation is a force (energy) to achieve any objective a person sets for himself or for the motivator without questioning the motive behind the objective assigned to him because of bonding created between him and the motivator.

3.5. Research Design

As Sellitz et al (1965) state. “A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.”

Ghauri et al (1995) proposed three types of research: exploratory research, descriptive research and casual research.

Exploratory research is conducted into an issue or problem where there are few or no earlier studies to refer to. The focus is on gaining insights and familiarity for later investigation. The objective of exploratory research is to gather preliminary information that will help define problems and suggest hypotheses. Exploratory studies are also necessary when some facts are known but more information is needed for developing a viable theoretical framework.

An exploratory study is undertaken when not much is known about the situation at hand or no information is available on how similar problem or research issues have been solved in the past. In such cases, extensive preliminary work needs to be done to gain familiarity with the phenomenon in the situation and understand what is
occurring before we develop a model and set up a rigorous design for comprehensive investigation.

On the contrary, descriptive research is used when the phenomenon is well structured and understood. This kind of approach requires a critical approach to the obtained information.

The casual research is used when the problems under research are structured. The main tasks under casual research are to isolate cause(s), and to tell whether and to what extent cause(s) result in effect. Both descriptive and casual research use structured problem.

As the aim of the present study is to find out the nature of relation between motivation level vs. Leadership Behaviour, Organizational Culture, Team Spirit, Personal Effectiveness and Financial Motivators, the problem statement implies that the author is aiming at understanding this unclear phenomenon, this research could be considered exploratory. Hence, the research design was exploratory research design.

An exploratory study using primary data was chosen as appropriate means to investigate the objectives and the hypotheses. With a view to capture the motivators effective in Indian Context, to carry out comparative analysis of Western and Eastern philosophies on motivation and to recommend new motivation model, questionnaires were devised to be answered by those who are actually employed in combat. As it is not possible to examine the entire population, sample population was chosen from managerial cadre and above.
3.6. Instrumentation

For the purpose of studying the objectives and testing the hypotheses, a two-pronged approach of data collection was undertaken, primary and secondary data collection.

**Primary data** was collected using structured questionnaires and telephonic interviews. According to the requirement of the study, the questionnaires (see Appendix 1 and 2) were designed for primary data collection. The questionnaires had closed-ended questions with multiple options and various measurement and scaling techniques for each question, such as Likert scale, rating method and ranking method for effective data collection. A checklist of questions/schedule of interview was also prepared for the Managerial employees in private and public sector in India, and Indian Armed Forces personnel for primary data collection through interview method.

Two questionnaires were used - one to capture the level of motivation of Defence Officers and the other to capture motivation of Managers and above in industrial organizations. Each questionnaire has two parts: first part measures the demographical information of the respondents and the second part captured the motivation factors of the Defence officers and employees in industrial organizations.
The items that constituted adequate coverage of the factors under study were decided and agreed upon by the researcher.

Accordingly, the first part consisting of the background information included gender, marital status, age, annual income, nationality and ARM or service as direct measures; designation, present posting and education reported as open measures. Defence Officers’ experience in a) peace station b) operations area (LC) and c) CIOPS (LIC) was captured as a direct measure.

The second part of the instrument consisted of the items that captured the level of motivation. There were 50 items each, captured using a 5-point scale. Out of which 33 items were made on a 5-point scale anchored by 1 = strongly disagree; 2 = disagree; 3 = can’t say; 4 = agree and 5 = strongly agree and the mean of the items under each factor was used as a composite measure of the respective factors. The remaining 17 items were again captured on a 5-point scale but made by 1 = never, 2 = rarely, 3 = sometimes, 4 = usually and 5 = actually.

Secondary data was collected from journals, business magazines, business newspapers, websites and statistical organizations.

The method of data collection involved the following procedure. Firstly, there was extensive review of available literature relevant for introduction to the theory and application of motivators, with special reference to India. Later came, the special attention to doctoral researches. The reviews were also helpful to know contributions of other authors and researchers to motivation. They also provided a frame of reference for the survey research in the Enterprises covered in the study.

Secondly, a purposive sample of total 450 respondents from Defence and Industry was drawn. Thirdly, a draft questionnaire was designed on the basis of the data generated from the review of literature. The draft questionnaire was pre-tested in some enterprises.
3.6.1. Validity test

The questionnaire was subjected to face and content validity whose determination was judgmental. There are two schools of thought on the distinctiveness of face and content validity. The first one saw face validity as just an indirect approach to the measurement of content validity (Carmines, & Zeller, 1979; Nunnally, 1967) whereas the second one treated them as separate and different tests (DeVellis, 1991; Kerlinger, 1973). In this study, the researcher has subscribed to the second perspective where quantitative assessment of the content validity has been followed. The face and content validity was conducted as follows with 4 experts. The experts scrutinized the items, according to the definition generated against the constructs of motivation. Before they offered their opinion on the items, the researcher informed them of the objectives and the need for the study. The experts were first encouraged to discuss among themselves, the validity of each item in capturing the adequate information required for the study. Then they were requested to offer their feedback on each of the items. The experts accepted the questionnaire in the same form and also suggested a 5-point rating scale for all the items. The content validity ratio (CVR) was applied to each item, using the formula developed by Lawsche (1975). Based on this, a few redundant statements were removed.

\[
\text{Content Validity Ratio} = \frac{\text{Ne} - \frac{N}{2}}{\frac{N}{2}}
\]

where Ne = number of panelists indicating “essential”

and N = total number of panelists.

All those items which have scored less than 0.50 on the content validity ratio have been removed from the study and content validity ratio (CVR) suggests that all the items originally developed by the researcher have scored more than 0.50. Based on the face validity and content validity ratio, the final number of items in each of the factors taking part in this study was decided.
3.6.2. The Pilot study

After finalizing the number of items in the research instrument using face and content validity tests, a pilot study was undertaken for the following reasons:

a) To assess the reliability of the research instrument constructed.
b) To ascertain the time taken to complete the questionnaire by the respondents.

To conduct the pilot study, it was decided to select a regiment and from the chosen regiment, 40 Defence officers were drawn from the list of the sampling frame.

3.6.2.a. Results of the pilot study

The verbatim record of the transaction that took place while administering the questionnaire was noted. The discussion with the Defence Officers during the pilot study revealed that the instrument has adequate stimulus value to gather authentic responses from the respondents. The transaction also suggested that the procedures adopted in administering the instruments are practicable. Hence, it was concluded that the instrument used in the study would elicit the necessary data required from the respondents. It has been found that the respondents took invariably between 35 – 45 minutes to completely fill the questionnaire.

3.6.2.b. Reliability test.

The data collected from the pilot study was subjected to reliability test using Cronbach Alpha. The alpha values for the various dimensions are shown in table 3.1. From the table, it has been found that the reliability coefficients for the variables chosen for this study are more than 0.60, which is an acceptable value (Malhotra, 2004). So, the items constituting each variable under study have reasonable internal consistency.

Table 3.1: Reliability coefficients using Cronbach Alpha

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Dimensions</th>
<th>Reliability Coefficients (N = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Motivation</td>
<td>0.861</td>
</tr>
</tbody>
</table>
3.7 Sampling frame

The geographical area across India was chosen as the Universe. The main reason for choosing the entire country is that Defence Officers and the Managerial Employees from industry spread across the country can reflect their motivational factors driven by statutory conditions being the same irrespective of the geographical location.

Hence, out of a universe comprising of employees from manufacturing and service organizations from public and private sector and Indian Armed Forces personnel spread across India, the researcher selected a purposive sample of 150 Managerial personnel in private sector organizations in India, of which – 50 Managerial personnel working in small enterprises, 50 Managerial personnel working in medium enterprises, and 50 Managerial personnel working in large enterprises; 150 Managerial personnel in public sector organizations; and 150 Indian Armed Forces personnel of Officer’s rank. Therefore, a total sample size of about 450 respondents was taken for the study.

Emphasis was primarily laid on studying the motivation in Indian context; however, some western employees were also interviewed to understand the applicability of western motivation theories better.

Table 3.2: Sampling Frame

<table>
<thead>
<tr>
<th>Universe</th>
<th>Purposive Sample</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Armed Forces</td>
<td>Officer rank &amp; above</td>
<td>150</td>
</tr>
<tr>
<td>Industry</td>
<td>Public Sector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manager cadre &amp; above</td>
<td>150</td>
</tr>
<tr>
<td>Industry</td>
<td>Private Sector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small enterprise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Managers &amp; above</td>
<td>50</td>
</tr>
<tr>
<td>Industry</td>
<td>Medium enterprise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Managers &amp; above</td>
<td>50</td>
</tr>
<tr>
<td>Industry</td>
<td>Large enterprise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Managers &amp; above</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>450</td>
</tr>
</tbody>
</table>
3.8 Sampling technique

Representative purposive sample, collected according to availability, was such which gave a true and unbiased picture of the population. Utmost care was taken to make sure that there is insignificant sampling error and the results of the sample study can be applied, in general, for the universe with a reasonable level of confidence.

The researcher contacted her friends, peers and former colleagues working in those regiments / organizations to identify the respondents, based on the condition that they should have worked in the same regiment/organization for at least two years. This was done to ensure that the respondents would have perceptible response on motivation. This was followed based on the suggestion offered by the panelists constituted for the validity test. However, no distinction was made between different levels among the Officers and Managers.

3.9 Administration

The questionnaire was administered to all the 150 Defence officers identified. Almost half of the questionnaires were administered in person and the remaining by choosing a contact person in each regiment, through whom the questionnaires were distributed. However, the researcher personally met the respondents or contacted them over phone, to solicit their kind cooperation in filling up the questionnaire.

To instil confidence in the minds of the respondents, the questionnaire was attached with a covering letter, describing the purpose for which the data was collected. They were ensured that their responses would be used only for academic purpose and were assured absolute confidentiality and anonymity on the information sought. This was done based on the suggestions given by the respondents in the pilot study, in order to encourage and solicit the kind cooperation of the respondents, in giving complete and accurate information. A thorough follow-up was done in person and over telephone to expedite the process of filling up the questionnaire, yielding a response rate of 100% (450 usable questionnaires).

The frequency tables of the total responses from 450 respondents w.r.t. their age, marital status and experience are as under:
Table 3.3: Frequency Table for Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Not Disclosed</td>
<td>16</td>
<td>3.6</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Less than 30 yrs</td>
<td>41</td>
<td>9.1</td>
<td>9.1</td>
<td>12.7</td>
</tr>
<tr>
<td>30 - 40 yrs</td>
<td>221</td>
<td>49.1</td>
<td>49.1</td>
<td>61.8</td>
</tr>
<tr>
<td>40 yrs or above</td>
<td>172</td>
<td>38.2</td>
<td>38.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>450</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3.2: Graph for frequency values for age

Table 3.4: Frequency Table for Marital Status
### Marital

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Disclosed</td>
<td>19</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Married</td>
<td>391</td>
<td>86.9</td>
<td>86.9</td>
<td>91.1</td>
</tr>
<tr>
<td>Unmarried</td>
<td>40</td>
<td>8.9</td>
<td>8.9</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>450</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

![Pie chart](image)

**Fig. 3.3:** Graph for frequency values for marital status
Table 3.5: Frequency Table for Experience

<table>
<thead>
<tr>
<th>Exp</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Not Disclosed</td>
<td>5</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Less than 5 yrs</td>
<td>40</td>
<td>8.9</td>
<td>8.9</td>
<td>10.0</td>
</tr>
<tr>
<td>5 - 10 yrs</td>
<td>162</td>
<td>36.0</td>
<td>36.0</td>
<td>46.0</td>
</tr>
<tr>
<td>10 yrs or above</td>
<td>243</td>
<td>54.0</td>
<td>54.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>450</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3.4: Graph for frequency values for experience
3.10 Techniques used for analysis

The statistical software, SPSS - PASW v 17.0 was used for efficient and effective data analysis techniques of Chi-Square test, One-way ANOVA and Multiple Regression. So as to project the results truly representative of the population, and make the research relevant, 450 respondents were approached extensively through questionnaires and interviews. Data collection was probably the most difficult part of the research. Getting people to cooperate by filling out the elaborate questionnaire was an arduous task.

The results obtained have been tabulated and reported such that the relationship between the dependant and the independent variables is clearly brought out.

Step-wise multiple regression was used to study the influence of leadership behaviour, organization culture, team spirit, personal effectiveness and financial motivators. Chi-square was used to examine the difference in the background characteristics.

3.10.1 Pearson's chi-square ($\chi^2$) test

Pearson's chi-square ($\chi^2$) test is the best-known statistical procedures whose results are evaluated by reference to the chi-square distribution. Its properties were first investigated by Karl Pearson in 1900. In contexts where it is important to make a distinction between the test statistic and its distribution, names similar to Pearson X-squared test or statistic are used.

It tests a null hypothesis stating that the frequency distribution of certain events observed in a sample is consistent with a particular theoretical distribution. The events considered must be mutually exclusive and have total probability 1. A common case for this is where the events each cover an outcome of a categorical variable. A simple example is the hypothesis that an ordinary six-sided die is "fair", i.e., all six outcomes are equally likely to occur.

Pearson's chi-square is used to assess two types of comparison: tests of goodness of fit and tests of independence.
A test of goodness of fit establishes whether or not an observed frequency distribution differs from a theoretical distribution.

A test of independence assesses whether paired observations on two variables, expressed in a contingency table, are independent of each other – for example, whether people from different regions differ in the frequency with which they report that they support a political candidate.

The first step in the chi-square test is to calculate the chi-square statistic. In order to avoid ambiguity, the value of the test-statistic is denoted by \( X^2 \) rather than \( \chi^2 \) (i.e. uppercase chi instead of lowercase); this also serves as a reminder that the distribution of the test statistic is not exactly that of a chi-square random variable. However some authors do use the \( \chi^2 \) notation for the test statistic. An exact test which does not rely on using the approximate \( \chi^2 \) distribution is Fisher's exact test: this is significantly more accurate in evaluating the significance level of the test, especially with small numbers of observation.

The chi-square statistic is calculated by finding the difference between each observed and theoretical frequency for each possible outcome, squaring them, dividing each by the theoretical frequency, and taking the sum of the results. A second important part of determining the test statistic is to define the degrees of freedom of the test: this is essentially the number of observed frequencies adjusted for the effect of using some of those observations to define the "theoretical frequencies".

3.10.1.a Test for fit of a distribution

Discrete uniform distribution -

In this case \( N \) observations are divided among \( n \) cells. A simple application is to test the hypothesis that, in the general population, values would occur in each cell with equal frequency. The "theoretical frequency" for any cell (under the null hypothesis of a discrete uniform distribution) is thus calculated as

\[
E_i = \frac{N}{n}
\]
and the reduction in the degrees of freedom is \( p = 1 \), notionally because the observed frequencies \( O_i \) are constrained to sum to \( N \).

**Other distributions -**

When testing whether observations are random variables whose distribution belongs to a given family of distributions, the "theoretical frequencies" are calculated using a distribution from that family fitted in some standard way. The reduction in the degrees of freedom is calculated as \( p = s + 1 \), where \( s \) is the number of parameters used in fitting the distribution. For instance, when checking a 3-parameter Weibull distribution, \( p = 4 \), and when checking a normal distribution (where the parameters are mean and standard deviation), \( p = 3 \). In other words, there will be \( n - p \) degrees of freedom, where \( n \) is the number of categories.

It should be noted that the degrees of freedom are not based on the number of observations as with a Student's t or F-distribution. For example, if testing for a fair, six-sided die, there would be five degrees of freedom because there are six categories/parameters (each number). The number of times the die is rolled will have absolutely no effect on the number of degrees of freedom.

**3.10.1.b Calculating the test-statistic**

The value of the test-statistic is

\[
X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i},
\]

where,

\( X^2 \) = Pearson's cumulative test statistic, which asymptotically approaches a \( \chi^2 \) distribution.

\( O_i \) = an observed frequency;

\( E_i \) = an expected (theoretical) frequency, asserted by the null hypothesis;

\( n \) = the number of cells in the table.
The chi-square statistic can then be used to calculate a p-value by comparing the value of the statistic to a chi-squared distribution. The number of degrees of freedom is equal to the number of cells \( n \), minus the reduction in degrees of freedom, \( p \).

The result about the number of degrees of freedom is valid when the original data was multinomial and hence the estimated parameters are efficient for minimizing the chi-square statistic. More generally however, when maximum likelihood estimation does not coincide with minimum chi-square estimation, the distribution will lie somewhere between a chi-square distribution with \( n - 1 - p \) and \( n - 1 \) degrees of freedom (Chernoff and Lehmann, 1954).

3.10.2. Cross Tab

Cross tabulation is the process of creating a contingency table from the multivariate frequency distribution of statistical variables. Heavily used in survey research, cross tabulations (or cross-tabs for short) can be produced by a range of statistical packages, including some that are specialized for the task. A matrix display of the categories of two nominal scaled variables, containing frequency counts of number of subjects in each bivariate category is called cross-tabulation table or contingency table. A Cross Table has each cell showing the number of respondents which gives a particular combination of replies.

Crosstab, or Cross Tabulation, is a process or function that combines and/or summarizes data from one or more sources into a concise format for analysis or reporting. Crosstabs display the joint distribution of two or more variables and they are usually represented in the form of a contingency table in a matrix. A Crosstab should never be mistaken for frequency distribution because the latter provides distribution of one variable only.

Cross Tabulations are popular choices for statistical reporting because they are very easy to understand and they are laid out in a clear format. They can be used with any level of data whether the data is ordinal, nominal, interval or ratio because the Crosstab will treat all of them as if they are nominal data. Crosstab tables provide more detailed insights to a single statistics in a simple way and they solve the problem of empty or sparse cells.
Since Cross Tabulation is widely used in statistics, there are many statistical process and terms that are closely associated with it. Most of these processes are methods to test the strengths of Crosstabs which is needed to maintain consistency and come up with accurate data because data being laid out using Crosstabs may come from a wide variety of sources.

The Lambda Coefficient is a method of testing the strength of association of Crosstabs when the variables are measured at nominal level. Cramer’s V is another testing method that tests the strength of Crosstabs which adjusts the number of rows and columns. Other ways to test the strength of Crosstabs associations include Chi-square, Contingency Coefficient, Phi Coefficient and the Kendall tau.

3.10.3. Step-wise Multiple Regression Analysis

Regression Analysis is a powerful and flexible procedure for analyzing associative relationship between a dependant variable and one or more independent variables. Although the independent variables can explain the variation in the dependant variable, this does not necessarily imply causation. The use of the terms, dependant or criterion variables and independent or predictor variables in regression analysis arises from the mathematical relationship between the variables. These terms do not imply that the criterion variable is dependant on the independent variables in a causal sense. Regression analysis is concerned with the nature and degree of association between variables and does not imply or assume any causality (Malhotra, 2005).

The general form of the multiple regression model is as follows, where $Y$ is the dependant variable and $X_1, X_2, \ldots, X_i$ are the independent variables,

$$Y_i = \alpha + \beta X_i + \epsilon_i$$

where, the subscript $i$ refers to the $i^{th}$ observation, $\alpha$ is the intercept and $\beta$ is the regression coefficient. The intercept, $\alpha$, is so called, because it intercepts the Y-axis. It estimates the average value of $Y$, when $X=0$, which is estimated by the following equation:

$$\hat{Y} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_i X_i$$
The coefficient $\alpha$ represents the intercept and $\beta$s are the partial regression coefficients. If $\hat{Y} = \alpha + \beta_1 X_1 + \beta_2 X_2$, then the interpretation of the partial regression coefficient, $\beta_1$, is that it represents the expected change in $Y$ when $X_1$ is changed by one unit but $X_2$ is held constant or otherwise controlled. Likewise, $\beta_2$ represents the expected change in $Y$ when $X_2$ is changed by one unit but $X_1$ is held constant or otherwise controlled. The combined effect of $X_1$ and $X_2$ on $Y$ is additive, which means that if $X_1$ and $X_2$ are each changed by one unit, the expected change in $Y$ would be $(\beta_1 + \beta_2)$.

The regression model is based on the following assumptions:

- The relationship between $X$ and $Y$ is linear.
- The expected value of the error term is zero.
- The variance of the error term is constant for all the values of the independent variable, $X$. This is the assumption of homoscedasticity.
- There is no autocorrelation. $E(\varepsilon_i \varepsilon_j) = 0$.
- The independent variable is uncorrelated with the error term.
- The error term is normally distributed.

### 3.10.3.a Estimation of Parameters

The random sample of observations can be used to estimate the parameters of the regression equation. The method of least squares is used to fit a continuous dependent variable ($Y$) as a linear function of a single predictor variable ($X$). The least squares method finds the line which minimizes the sum of squared deviations from each point in the sample to the point on the line corresponding to the $X$-value. Given a set of $n$ observations $Y_i$ of the dependent variable corresponding to a set of values $X_i$ of the predictor, and the assumed regression model, the $i^{th}$ residual is defined as the difference between the $i^{th}$ observation $Y_i$ and the fitted value $\hat{Y}_i$.

$$d_i = (\hat{Y}_i - Y_i)$$

The least square line is:

$$\hat{Y} = A + BX$$
where

\[ B = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2} \]

and

\[ A = \bar{y} - B \bar{x} \]

Here \( \bar{x} \) and \( \bar{y} \) denote the sample means of \( X \) and \( Y \), and \( \hat{y} \) denotes the predicted value of \( Y \) for a given \( X \).

The estimate of \( \sigma^2 \) is called the residual mean square and is computed as:

\[ s^2 = \frac{\sum(y - \hat{y})^2}{n - 2} \]

The number \( n - 2 \), called the residual degrees of freedom, is the sample size minus the number of parameter (in this case, \( \alpha \) and \( \beta \)).

The square root of the Residual Mean Square (RMS) is called the standard error of the estimate and is denoted by \( S \). In effect, it indicates the reliability of the estimating equation. Standard errors of \( A \) and \( B \) are

\[ SE(A) = \sqrt{\frac{1}{n} + \frac{\bar{x}^2}{\sum(x - \bar{x})^2}} \]

\[ SE(B) = \frac{S}{\sum(x - \bar{x})^2} \]

3.10.3.b Standardized regression coefficient

The standardized regression coefficient is the slope in the regression equation if \( X \) and \( Y \) are standardized. After standardization, the intercept (\( A \)) will be equal to zero. And the standardized slope will be equal to the correlation coefficient \( r \).
3.10.3.c Goodness of fit

Another common statistic associated with regression analysis is the R2. This has a simple definition—it is equal to one minus the ratio of the sum of squared estimated errors (the deviation of the actual value of the dependent variable from the regression line) to the sum of squared deviations about the mean of the dependent variable. Intuitively, the sum of squared deviations about its mean is a measure of the total variation of the dependent variable.

The sum of squared deviations about the regression line is a measure of the extent to which the regression fails to explain the dependent variable (a measure of the noise). Hence, the R2 statistic is a measure of the extent to which the total variation of the dependent variable is explained by the regression. It is not difficult to show that the R2 statistic necessarily takes on a value between zero and one. A high value of R2, suggesting that the regression model explains the variation in the dependent variable well, is obviously important if one wishes to use the model for predictive or forecasting purposes.

3.10.3.d Significance of regression

Significance testing involves testing the significance of the overall regression equation as well as specific partial regression coefficients. The overall test of the regression equation is conducted by using an F Statistic. Testing of the significance of the partial coefficients is done by using the t test.

For testing the null hypothesis $H_0: b = 0$, it is expedient to represent the results of regression analysis in the form of an analysis of variance (ANOVA) table. If $X$ were useless in predicting $Y$, the best estimate of $Y$ would be $ar{Y}$, regardless of the values of $X$. To measure how different the fitted line $\hat{Y}$ is from $\bar{Y}$, we calculate the sum of squares for regression as $\sum (Y - \hat{Y})^2$, summed over each data point. The residual mean square is a measure of how poorly or how well the regression line fits the actual data points. A large residual mean square indicates poor fit. If residual mean square is large, the value of F would be low and F ratio may become non-significant. If F ratio is statistically significant it implies that the null hypothesis $H_0: b = 0$ is rejected.
Table 3.6: ANOVA Table for Simple Linear Regression

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sums of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>( \sum (\hat{y} - \bar{y})^2 )</td>
<td>1</td>
<td>( SS_{\text{reg}} / 1 )</td>
<td>( MS_{\text{reg}} / MS_{\text{res}} )</td>
</tr>
<tr>
<td>Residual</td>
<td>( \sum (y' - \hat{y}')^2 )</td>
<td>( N - 2 )</td>
<td>( SS_{\text{res}} / (N - 2) )</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>( \sum (y' - \bar{y}')^2 )</td>
<td>( N - 1 )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.10.4. Factor Analysis

Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved, uncorrelated variables called factors. In other words, it is possible, for example, that variations in three or four observed variables mainly reflect the variations in fewer such unobserved variables. Factor analysis searches for such joint variations in response to unobserved latent variables. The observed variables are modelled as linear combinations of the potential factors, plus "error" terms. The information gained about the interdependencies between observed variables can be used later to reduce the set of variables in a dataset.

The first item from the output is the Kaiser-Meyer-Olkin (KMO) and Bartlett's test. The KMO measures the sampling adequacy that should be greater than 0.5 for a satisfactory factor analysis, to go further.

Scree plot is a plot, in descending order of magnitude, of the eigen-values of a correlation matrix. In the context of factor analysis or principal components analysis, a scree plot helps the analyst visualize the relative importance of the factors — a sharp drop in the plot signals that subsequent factors are ignorable. How many factors should be retained for analysis? There is no clear answer but a couple of rules of thumb. One rule is to consider only those with eigen values over 1. Another rule of thumb is to plot all the eigen values in their decreasing order.
The plot looks like the side of a mountain, and "scree" refers to the debris fallen from a mountain and lying at its base. So the scree test proposes to stop analysis at the point the mountain ends and the debris (error) begins.

The Rotated Component Matrix shows the factor loadings for each variable. The idea of rotation is to reduce the number factors on which the variables under investigation have high loadings. Rotation does not actually change anything but makes the interpretation of the analysis easier.

3.11 Limitations of the Study

1. The organizations chosen for the study were based on convenience. However, adequate attention was paid to selecting the organizations that fulfilled the parameters of the research.

2. As a field study, the research was mainly based on self-perceived motives and beliefs, which is not sufficient to build a comprehensive picture of motivation. The study of motivation level requires an in-depth probe as it is presumed that each organization has its own work environment, requiring varied motivators. However, care has been taken to get a bigger picture of universality of motivators by choosing Defence, public and private (small, medium, large-sized) organizations as population.

3. The current study relies on questionnaire investigation with concise question contents and lacks the depth of qualitative research methods. The main reason for this could be attributed to the paucity of time and resource constraints.