CHAPTER 3

RESEARCH METHODOLOGY

This study examined corporate effectiveness by using Kirkpatrick’s training evaluation model (Kirkpatrick & Kirkpatrick, 2006)\(^1\) by assessing the training programs conducted in the sample organization of the thermal power plants, i.e. Public sector- Feroze Ghandi National Thermal Power Corporation Limited, (NTPC) and Private sector- ROSA Thermal Plant, which is hold by Reliance Corporation Limited. The research question and four hypotheses served as the foundation and purpose of this study and are further addressed in this chapter. This chapter also discusses the methodological rationale and review of methodological literature of the study, the population and sample, the training program/intervention, the data collected, and the analysis of the data.

Objectives

The following are the objectives of the study:-

1. To identify employee’s getting training leads to increase in knowledge of content and skill.
2. To judge the impact of training on employee’s job performance.
3. To evaluate the training program on corporate effectiveness.
4. To evaluate employee learning and job performance to predict corporate effectiveness.
5. To find out how training program affect the public and private sector organization to increase their productivity, retention ratio, employee engagement and innovation.
Research Question and Hypotheses

This study was guided by the following research question and four research hypotheses.

Research Question

Do the data from a training program implemented in the Thermal Plant support the organizational effectiveness?

Research Hypotheses

To answer this basic research question, four research hypotheses served as the guides for the data to be collected and analyzed.

1. *Hypothesis (H₁)*. Employees who completed the training will improve their knowledge of the content and required skills (Level 2).
2. *Hypothesis (H₂)*. Employees who completed the training will improve their job performance (Level 3).
3. *Hypothesis (H₃)*. Employees who completed the training will contribute to increased corporate effectiveness (Level 4).
4. *Hypothesis (H₄)*. Employee learning (Level 2) and job performance (Level 3) will predict corporate effectiveness (Level 4).

The above research question and hypothesis will be analyzed in subsequent chapters.

Methodological Rationale and Review of Methodological Literature

Research Design

To examine impact of training on corporate effectiveness and using Kirkpatrick’s evaluation training techniques, the primary methodology being employed in conducting this research is a one group ex post facto analysis (Gay & Airasian, 2002; Newman,
Newman, Brown & McNeely, 2006). In this study, the attempt is to examine a training intervention based on comparative pre- and post-intervention performance outcome data. This is not an experimental study, as the training intervention, described later in this section, cannot be manipulated. In addition, there is no randomization, manipulation of the intervention, or the use of a control group that characterizes experimental research. These factors are a consistent situation when evaluating workgroups in organizations and are considered weaknesses of an ex post facto design (Gay & Airasian, 2002; Merriam & Simpson, 1995; Newman & Newman, 1994). There are, however, extensive and multiple data to assess the various variables; that is, knowledge and skills, job performance, and organizational effectiveness. The relationships between variables may be demonstrated. However, cause and effect relationships cannot be inferred.

Because of inability to appropriately identify causal relationships, many researchers “tend to regard ex post facto as inferior research that should not be conducted” (Newman & Newman, 1994, p. 115). However, Newman and Newman (1994) indicated that this is not necessarily true if the research question deals with relationships. By utilizing ex post facto design with tests of hypotheses, it is appropriate to increase the internal validity and explore relationships between variables. According to Newman and Newman (1994), ex post facto design also has the potential for the great amount of external validity when compared to other designs, such as experimental, quasi-experimental, and true-experimental research.

Furthermore, to determine the relationships between the variables and to use relationships in making predictions, there is need to examine the relationships of Kirkpatrick’s four levels of evaluation, and to examine the degree to which the variables are related (Gay & Airasian, 2002). According to Gay (1996, p. 305), “if two variables are highly related, scores on one variable can be used to predict scores on the other variable”. Therefore, “the variable upon which the prediction is made is referred to as the predictor, and the variable predicted is referred to as the criterion” (Gay, 1996, p. 305). Although a relationship study examines how each predictor variable is correlated with the criterion variable, a combination of variables usually results in a more accurate prediction than any one variable (Creswell, 2005; Gay 1996). A prediction study is appropriate for this research because it tests theoretical hypotheses concerning variables.
believed to be predictors of a criterion. In other words, by employing a prediction design, the study sought to anticipate performance outcomes by using specific variables as predictors. The variables and predictors in this study are the first three levels of performance outcomes, reaction, learning, and job performance, as identified by Kirkpatrick. The organizational effectiveness of Level 4 assessment is, therefore, the criterion. The test is to confirm the theoretical relationships predicted in Kirkpatrick’s model.

As concluded from the literature reviews of Attia’s (1998)\(^8\) and Phillips’ (2000)\(^9\) studies, Flynn’s recommendation (1998)\(^10\), and Kirkpatrick’s principles (Kirkpatrick & Kirkpatrick, 2006)\(^1\), Kirkpatrick’s evaluation model was used to assess different training programs. There are extensive data available to examine the multiple levels of dependent variables. In addition, because the general and ultimate goal of most training programs is to increase the production and profitability for all organizations, it was critical to follow Kirkpatrick’s model by assessing the employees’ knowledge and skill gains and job performance improvement, and how they relate to the production and the organizational effectiveness. Finally, Kirkpatrick and Kirkpatrick (Kirkpatrick & Kirkpatrick, 2005, 2006)\(^11\) recommend that HRD professionals and researchers utilize control groups whenever possible. However, it should not prohibit the attempts of evaluation if control groups cannot be used. In addition, based on Tidler’s (1999)\(^12\) study, a one-group ex post facto analysis is appropriate to examine the existing data in this study.

**Effect Size**

In a review of the published training and development literature from 1960 to 2000 (Arthur, Bennett, Edens, & Bell, 2003)\(^13\), the researchers conducted a meta-analysis of 162 training evaluation studies to examine the relationship between specified training design and evaluation features and the effectiveness of training in organizations. By utilizing Kirkpatrick’s model as the framework and his four levels as the evaluation criteria, the researchers found that the average or mean effect sizes \(d_s\) for training interventions were fairly large, regardless of the topics and methods used. The results are 0.60 for reaction criteria, 0.63 for learning criteria, 0.62 for behavior criteria, and 0.62
for results criteria. These results indicated a medium to large effect size for organizational training (Arthur et al., 2003)\(^{(13)}\), which was considered the guideline for this study as addressed in the following sample size section.

**Population and Sample**

The population for this study was taken from employees of executive and subordinate level from the leading thermal power plants, i.e. Public sector- Feroze Ghandi National Thermal Power Corporation Limited Uchahar unit, (NTPC) and Private sector- ROSA Thermal Plant, which is hold by Reliance Corporation Limited. During the study period, there were approx 800 employees’ were employed in Rosa thermal plant and approx 11000 employees’ in NTPC. The sample of this study was the employees’ who completed the training program and from whom complete pre-and-post training data were available. The number of employees’ taken was 109 form Rosa plant and 180 form NTPC. The employees included in the study were compared to the available variables of both the thermal power plants: type of employees’, length of employment and learning and skills, job performance, to ascertain whether or not differences existed.

**Sample Size**

According to Gay and Airasian (2002)\(^{(2)}\), the number of subjects significantly affects the power of a study. The power means the statistical ability to reject a false null hypothesis. In addition, “if the sample is too small, the results of the study may not be generalizable to the population” (Gay & Airasian, 2002, p. 111)\(^{(2)}\). However, in many situations, researchers have difficulties accessing large numbers of potential research participants. But the sample taken was 109 from Rosa and 180 from NTPC participants in this study; the statistical power requirements have been met. This sample size will yield 99% power in paired-sample t tests for a medium-large effect size, \(d = .6\) (Arthur et al., 2003)\(^{(13)}\).

Depending on the type of research involved, some experts consider the minimum sample size of 30 as a guideline for co-relational, causal-comparative, and true experimental research (Gay, 1996; Gay & Airasian, 2002)\(^{(6)(2)}\). For regression types of
analytic work, a good rule of thumb is 15 participants per variable (Tabachnick & Fidell, 2001)(14). However, because of the factors discussed previously, the appropriate method for this study is ex post facto analysis.

The Training Program/Intervention

The training intervention was a two and one-half day, some are one day, three days to seven days respectively classroom-based and technical and non-technical comprehensive courses for employees’. The basket training programs are conducted time to time according to the need of employees’ and of the organization. The study taken training program for which pre and post data are available were:- the Technical & Management Training, MS Office, Programming in C, and Power Plant Training, Employee Development Training, Energy Development and Management Training, as the measurements of productivity and creative thinking, problem solving and core value actualization as measurement of increased organizational effectiveness. The main objectives for thermal power plants is to provide a platform for the top Experts in Power Sector and power plant operators for knowledge exchange and resolving related problems and to identify challenges, develop common solutions and initiate joint action plans for power sector. Moreover, to engage pro-actively with foreign organizations such as VGB Germany, for Technical knowhow, Expertise, Consultancy, Studies and Reviews. Therefore, due to the changes in business climate and the continuous increasing competition, the thermal power plant recognized the significance of the employees’ who deliver the first impression to their organizational effectiveness and have direct impact on their bottom lines. Consequently, a training program/intervention has been delivered to the employees’ to provide the skills and ultimate performance to meet their new business objectives. The training was conducted by the learned learning coach (facilitator) from IIM professor to IIT to renowned training centers and even from abroad.

The evaluation of this program has primarily been the participant’s end-of-training evaluation and tests of the content learned, Levels 1 and 2 of Kirkpatrick’s model (Kirkpatrick & Kirkpatrick, 2006)(1). And both the thermal power plants comprehensive performance data has been collected data for both individual and organizational levels to evaluate job performance (Level 3), and corporate effectiveness (Level 4) for this study.
**Data Collection**

The study is purely based on primary data which has been collected from the concerned sample units i.e. Rosa Thermal Power plant and NTPC. The structured questionnaires are being used, which has been constructed on five point likert scale.

The data were retrieved from five departments, namely- purchase, finance, township development, planning and system and human resource management department. The specific time period to be studied was the two-and-a-half-year period of July 2013 to December 2015 for NTPC and from June 2013 to December 2015 for Rosa Plant. The study assessed the employees’ training outcomes of knowledge and skills, job performance, and the impact of the training upon the organization (productivity, retention ratio, and innovation). The different training programs were conducted from time to time to meet the need and requirement of the employees’, organization and to implement the new standards and practices to meet their objectives. The research will assess the training outcomes and their relationships.

For all the variables examined in this study, the pre training data consisted of the two months before training, and the post training data were two months after training. Two months was chosen because much variability was observed in a single month’s data. The data for three consecutive months’ pre and post training were unavailable for some employees’, which would exclude more employees’ being the study sample. In addition, this also minimized seasonality variability. The specific data used in this study were data analyzed to test the four hypotheses guiding this study. For the first hypothesis, the examination of knowledge and skills, the data analyzed were the employees’ in project management training with their respective departmental work. Immediate two months before and post training scores were used for this hypothesis. This assessment measured the employees’ knowledge and skills in handling computer (technical training). (see Appendix)

To analyze Hypothesis 2, job performance, the data were the Technical & Management Training, MS Office, Programming in C, and Power Plant Training, Employee Development Training, Energy Development and Management Training, as the measurements of productivity immediate two months before and post training (Attia, 1998; Cascio, 2000; Kirkpatrick & Kirkpatrick, 2006; Lockwood, 2001)\(^8\)\(^\text{15}\)\(^\text{1}\)\(^\text{16}\) the Technical
& Management Training is not only a job performance measurement, but also a business survival indicator. To successfully execute the work, the respective department employee’s have to apply their knowledge about machineries, the services, the various equipments, etc., and also their listening, interpersonal, and relationship skills. This affirms how vital the Technical & Management Training is as a key job performance measurement for all level employees’, and a key indicator for the organization success. The higher the ratio means more confirmed performance, and a more productive for the thermal plant.

Energy Development and Management Training is also a key job performance measurement of productivity which indicated that the employees spend doing specific tasks and should be measured to identify the results/outputs. Power plant training is another high measurement of productivity for the organization, it provides best practices in all areas of power sector and provide broad based expertise and facilitate bilateral cooperation in the Indian Thermal Power Sector. Another important variable for job performance is employee development training which will raise awareness for the need of excellence in Power Sector and will identify challenges, develop common solutions and initiate joint action plans for power sector.

In addition, programming in C and MS Office training variables also are the measures of Hypothesis 2, is also a key job performance measurement which indicated that the Whether the employee an established professional or new to the field, Microsoft in-person and online IT training will give you the expertise you need in a specific product or technology. When an employee learns from training, he can be confident that what he learn will be accurate, complete and up-to-date. Microsoft Office training is a set of desktop applications that offer flexible and powerful ways to organize, manage, and present information. Universally used in office settings, knowledge of Microsoft Office tools are a must for anyone in today's job market. Microsoft Office training from New Horizons will help the team effectively utilize all the features of Microsoft Office products such as Office 365, Microsoft Access, Microsoft Excel, Microsoft Publisher and outlook, Microsoft PowerPoint, Visio, Project, OneNote and Word. All the trainers were Microsoft Certified. While C is a general-purpose, imperative computer programming language, supporting structured programming, lexical variable scope and recursion. By design, C helps employees to constructs that map efficiently to typical machine instructions, and therefore it
has found lasting use in applications that had formerly been coded in assembly language, including operating systems, as well as various application software for computers ranging from supercomputers to embedded systems.

To assess the corporate effectiveness, Hypothesis 3, three measurements were conducted. First, the creative thinking which help to improve the creative performance of the overall team. Creative meetings are a great opportunity to spot gaps of others as well as seeing your own creative shortcomings. After the meeting, the inventory helps to what you saw (or didn’t see) and get to work filling those gaps. Moreover helps push one own idea for another person’s concept. Therefore, it is acceptable to utilize creative thinking training as one of the measurements for corporate effectiveness of this research.

Second, the problem solving which helps in good problem solving skills as the problem encounters. There is no one way in which all problems can be solved therefore it would be wonderful to have ability to solve all problems efficiently and in time without much difficulty.

Third, the measurement is core value actualization which is the engagement and empowerment of employee’s education, development and participation in value implementation efforts, which further helps in eliminating obstacles, challenging existing processes, creating value facilitating mechanisms and integrating value into human resource management practices.

For Hypothesis 4, the examination of the inter-level relationships between learning (Level 2), job performance (Level 3), and corporate effectiveness (Level 4) were examined. The data from Level 2 were employee learning and knowledge scores; from Level 3 were technical & management training, Microsoft office, programming in c, and power plant training, employee development training, energy development and management training; from Level 4 were creative problem solving, critical thinking and core value actualization.

**Analysis of the Data**

All data have been computed by the Statistical Package for the Social Sciences (SPSS) program and examined for statistical significance. Table 2 presents the data collected and how they were analyzed for each hypothesis. The analysis of the data
involved selected descriptive and inferential statistics. The descriptive statistics introduced the mean, the average performance of a group on a variable, and the standard deviation. For inferential statistics, the paired-samples $t$ tests were utilized to determine the difference between the means of two sets of data (pre and post training). An F test was used to determine if the $R^2$ was significantly different than 0 at an alpha of .05 for correlations and multiple regressions.

This rigorous and systematic approach uses a statistical power analysis by identifying appropriate sample size, the level of statistical significance (alpha), the amount of power desired in a study, and the effect size involved in statistical inference (Cohen, 1992; Creswell, 2005)(17)(18). A significance (or alpha) level is a probability level that reflects the maximum risk to take that any observed differences are due to chance (Creswell, 2005)(18). It is usually set at .05 (Cohen, 1992; Creswell, 2005; Newman & Newman, 1994)(17)(18)(19). One-tailed test of significance was utilized, as the research indicates a probable direction. According to Creswell (2005)(18), a one-tailed test has more power, which means more likely the hypothesis will be rejected.
Table 3.1

Summary of the Variables Needed and Statistical Tests Used to Analyze Each of the Four Hypotheses

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<th>H2</th>
<th>H3</th>
<th>H4</th>
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<td>Critical thinking T;</td>
<td>learning skills</td>
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<td>Collected</td>
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<td>Problem solving T;</td>
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<td>Employee development T;</td>
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<td>Core value actualization Training.</td>
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| Analysis of the Data | learning skills assessment score (paired-samples t test). | Total # of above for improve job Performance (paired-samples t test). | paired-samples t test); contribute to corporate effectiveness | F test |

To analyze hypothesis 1, the examination of the knowledge and skills, pre and post training was measured by an objective technical learning and knowledge skills training assessment of the employees completing the training. Paired-samples t tests were used to analyze the data.

To analyze Hypothesis 2, job performance, the technical & management training, microsoft office, programming in c, and power plant training, employee development training, energy development and management training from pre and post training were measured. Paired-samples t tests were used to analyze the data.

To analyze Hypothesis 3, corporate effectiveness, three calculations were conducted for analyzing this hypothesis. First, Critical thinking training was calculated. Second, the employee problem solving training was calculated. Third, the core value actualization was calculated. And were compared from the pre and post training by
paired-samples t tests.

To analyze Hypothesis 4, the inter-level relationships among learning as measured by change in learning and knowledge skills scores from pre to post training (Level 2), job performance as measured by change in the technical & management training, microsoft office, programming in c, and power plant training, employee development training, energy development and management training from pre to post (Level 3), and cooperate effectiveness as measured by the increase in problem solving, critical thinking and core actualization training scores (Level 4) were examined. The training/intervention data were utilized for a hierarchical regression test to see if the gains in Levels 2 and 3 can be used to predict gains in Level 4. Multiple regressions, as defined by Creswell (2005), are a statistical procedure for examining the combined relationship of multiple independent variables (the Levels 2 and 3 outcomes) with a single dependent variable (Level 4 outcome). “In regression, the variation in the dependent variable is explained by the variance of each independent variable (the relative importance of each predictor), as well as the combined effect of all independent variables (the proportion of criterion variance explained by all predictors), designed by $R^2$” (Creswell, 2005, p. 336). An F test was used to determine if the $R^2$ was significantly different than 0 at an alpha of .05. The F test is chosen as it is very robust and is the most frequently used test of significance (Creswell, 2005; McNeil, Newman & Kelly, 1996). Results were considered significant is $p < .05$. 

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Limitation of This Study

Due to the nature under which this study was conducted, there are two limitations that have been mentioned previously in this chapter. First, the study was an ex post facto study, with the data collected over a two-and-a-half year period, from June 2013 to May 2015. There is an inability to randomly assign and manipulate the independent variables since they had already occurred and were not under the control of the researcher. Second, a control group of non-trainees could not be formed.

Summary

This methodology chapter discussed the methodological rationale and review of methodological literature of the study, the population and sample, the training program/intervention, the data collected, and analysis of the data. Next, the detailed results of data analysis are presented in chapter 4.
References


