Chapter I

INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

The People Capability Maturity Model is a roadmap for implementing workforce practices that continuously improve the capability of an organization’s workforce. Since an organization cannot implement all of the best workforce practices in an afternoon, the People CMM introduces them in stages. Each progressive level of the People CMM produces a unique transformation in the organization’s culture by equipping it with more powerful practices for attracting, developing, organizing, motivating, and retaining its workforce. Thus, the People CMM establishes an integrated system of workforce practices that matures through increasing alignment with the organization’s business objectives, performance, and changing needs.

The People CMM’s primary objective is to improve the capability of the workforce. In order to measure and improve capability, the workforce in most organizations must be divided into its constituent workforce competencies. Each workforce competency represents a unique integration of knowledge, skills, and process abilities acquired through specialized education or work experience. Strategically, an organization wants to design its workforce to include the various workforce competencies required to perform the business activities underlying its core competency. Each of these workforce competencies can be characterized by its capability—the profile of knowledge, skills, and process abilities available to the organization in that domain.
The People CMM describes an evolutionary improvement path from ad hoc, inconsistently performed workforce practices, to a mature infrastructure of practices for continuously elevating workforce capability.

Since the People CMM is an evolutionary framework, it guides organizations in selecting high priority improvement actions based on the current maturity of their workforce practices. The benefit of the People CMM is in narrowing the scope of improvement activities to those vital few practices that provide the next foundational layer for developing an organization’s workforce. By concentrating on a focused set of practices and working aggressively to install them, organizations can steadily improve their workforce and make lasting gains in their performance and competitiveness.

The P-CMM guides an organization through a series of increasingly sophisticated practices and activities for developing its workforce. These practices have been chosen from industrial experience as those that have significant impact on individual, team, unit, and organizational performance.

The People CMM has proven popular because it allows organizations to characterize the maturity of their workforce practices against a benchmark being used by other organizations.

Many workforce benchmarks focus on employee attitudes and satisfaction rather than workforce practices. Although attitudes and satisfaction are important predictors of outcomes such as turnover, they do not always provide the guidance necessary for identifying which practices should be improved next. In contrast, the staged framework of the People CMM helps organizations prioritize for their improvement actions. In addition, since the People CMM treats workforce development as an organizational process, improved workforce practices are easier to integrate with other process improvement activities².
1.2 NEED FOR THE STUDY

Forty years ago people feared that technology would reduce the need for educated workers, leaving large segments of the population unemployed. The opposite occurred. In fact, the demand for educated workers exceeds the supply. In the knowledge economy, companies are competing in two markets, one for its products and services and one for the talent required to develop and deliver them. With current low unemployment, the talent market is all the more competitive. Recruiting and retention are now as important as production and distribution in the corporate business strategies of knowledge-intense companies. Although most companies understand the importance of attracting and retaining talent, many lack a coherent approach to achieving their talent goals. Further, most lack a vision of how to integrate a system of practices to achieve their workforce objectives. Increased competition given rise to new process models and techniques to compete with a stress on workforce empowerment and productivity. One such technique that has been around for the past few years is PCMM. This highly motivated the researcher to study about the impact of implementation of PCMM.

1.3 OBJECTIVES OF THE STUDY

- To study about the maturity levels in People Capability Maturity Model.
- To study about key process area in each maturity level in PCMM.
- To study about the key practices implemented for increasing the work force capabilities of the employees in the PCMM level companies.
- To find out the reasons for implementing PCMM in software companies.
- To evaluate the effectiveness of implementation of PCMM in software companies.
- To find out the problems faced by the organization while implementing PCMM.
- To find out the advantages of PCMM companies over Non-PCMM companies.
1.4 SCOPE OF THE STUDY

This study would help to analyze the effectiveness and importance of implementation of PCMM in Software Companies. The effectiveness of the implementation of the PCMM can be fully evaluated by analyzing all the key process areas and key practices in all PCMM levels. So that, PCMM level 5 certified software companies have been considered for the study. Since it is difficult task to cover up all PCMM level 5 software companies in our country, the research study has been restricted to PCMM level 5 certified software companies in Chennai city. This study would definitely show the improvements and issues in all the key process areas of Human Resource Management after the implementation of PCMM. Also, it would help the Non-PCMM organization in decision making regarding the implementation of PCMM.

1.5 RESEARCH METHODOLOGY

The following is the methodology followed by the researcher to carry out this research.

1.5.1 Research Design

Research design is the conceived plan and structure of investigation to obtain answers to the research questions. The problem under research is to describe certain characteristics such as applications, dependency, acceptability and advantages of the subject matter under consideration. The researcher has brought out the existing nature of these characteristics of the subject matter with respect to the study organization with the help of detailed analysis of the collected data. Hence the research design that has been adopted for this research is ‘Descriptive’ analysis.
1.5.2 Descriptive Research

The major purpose of descriptive research is description of the state of affairs as it exists at present. The researcher has no control over the variables but only reports as to what has happened or what is happening. Descriptive research will facilitate the researcher to obtain accurate and complete information regarding a concept or a situation or a practice. The methods of research utilized in descriptive research are survey methods including comparative and correlation methods. Descriptive research studies are concerned with describing the characteristics of a particular individual, or of a group. Descriptive studies are those concerned with specific predictions, narration of facts and characteristics concerning individual, group or situation. The objective of a descriptive study will revolve around who, what, when, where and how of a topic.

1.5.3 Pilot Study

Before peeping into the area of the people capability maturity model in software companies, a pilot study was conducted to find the feasibility and the relevance of the present study. For this purpose contact had been made with the PCMM level 5 software companies to the various segments of the employees, like, team members, team leaders, project managers and HR professionals for assessing the significance and validity of carrying out the research work. As per the favourable results from the pilot study, the present research was conducted.

1.5.4 Data Collection

In the present study both primary and secondary data have been used. The secondary data have been collected from the reports, magazines, newspapers, textbooks and websites. Further, the researcher has gathered information from
international and national journals in the field of management including Human Resources, business magazines, business dailies, referred text books in Human Resource Management and academic studies conducted in the related areas for the purpose to build up a strong conceptual background including the review of literature for the study.

Primary data have been collected through questionnaire from the Human Resource Professionals, Team Leaders / Project Managers and Team Members in PCMM Level 5 Software Companies in Chennai city.

1.5.5 Methods of data collection

For the descriptive type of researches, the best – suited research approach is survey method. From a sample, data is collected and the different magnitudes are measured with respect to the whole population.

The researcher has used a structured questionnaire for the purpose of collecting primary data from the Human Resource professionals, Team Leaders / Project Managers and Team Members in PCMM Level 5 Software Companies in Chennai city.

1.5.6 Design of the Questionnaire

The questionnaire has been designed for collecting the data from the employees of these PCMM Level 5 software companies who have experiences in both PCMM and Non-PCMM Level. The questionnaire is divided in to two parts as common to all the respondents and questions related especially to the HR Professionals. The questionnaire totally consists of twenty three questions. The model of the questionnaire is given in the annexure.
1.5.7 Pre-testing of the questionnaire

In order to test the validity of the designed questionnaire a pre-test survey has been carried out mainly to see i) whether the respondents have understood all the questions in the questionnaire and ii) whether any particular questions have been unanswerable by the respondents. Pre-testing of the questionnaire implies that it is tried out on a few respondents and the reaction to the questionnaire is observed. It helps us in deciding whether any changes in the question content or the wording of questions are called for. For pre-testing the questionnaire, totally 50 respondents from the PCMM level 5 companies were surveyed. It was understood from the pre-test survey that the respondents felt difficulty in answering to few questions because of exhaustive invigilation of the Key process areas of the PCMM Model. So, the researcher sought help to redesign the questions based on the convenience of the respondents. Moreover while carrying out the pre-test survey the researcher could get some relevant questions and also got some inputs to strengthen the rating scale used in the questionnaire from the response of the respondents. Later all questions were inserted in the appropriate places of the questionnaire.

Detailed discussions with the academicians and Experts were held to determine the content validity, which was found to be good.

1.5.8 Sampling design

Sampling design includes the sampling unit, sample population, sample size and the sampling method employed for identifying the potential respondents.

1.5.8.1 Sampling Unit

This research considered only PCMM Level 5 Software Companies. The study area was Software Companies in Chennai City. In Chennai City, there are totally 1082
software companies. Among them, there are only 11 Software Companies having PCMM Level 5 certification. These 11 software companies have been considered as the sampling unit for the study.

1.5.8.2 Population

The employees of these 11 software companies who have experiences in both PCMM and non PCMM Level were taken as population. Totally 108 HR professionals and 4486 Team Leaders / Project Managers and 726 Team Members who have experiences in PCMM and Non-PCMM level.

1.5.8.3 Sample size and Sampling Method

The population was divided as project based and non project based strata. The project based strata was again divided as Team Leaders / Project Managers and Team Members. Human resource professionals were coming under non-project based strata.

The population of non-project based strata was 108 human resource professionals who have experiences in PCMM and Non-PCMM level. For non-project based strata, census method was adopted.

In project based strata, the population of Team Leaders / Project Manager who have experiences in PCMM and Non-PCMM level was 4486 and team members who have experiences in PCMM and Non-PCMM level was 726. Stratified random sampling was adopted for identifying the sample in project based strata.

Based on the pilot study results, using formula, the sample size was determined as 603 at 3 percentage acceptable error (precision level) and 95 percentage confidence level. The sample size for Team Leader / Project Managers were taken as 519 and team members were taken as 84 based on proportionate sample size determination.

The formula used for sample size determination was:
**Sample Size**

\[ n = \frac{Z^2pqN}{e^2(N-1) + Z^2pq} \]

- \( Z = 1.96 \) (normal distribution table value at 95% confidence level)
- \( p = 0.8, q = 0.2 \) (pilot study result)
- \( N = 5212 \) (Total population of project based strata)
- \( e = 0.03 \) (acceptable error)

### 1.5.9 Hypotheses of the study

The following research hypotheses have been framed on the basis of the objectives set for the study:

1) The designation of the respondents has no impact on understanding of PCMM Level 2 Key practices.

2) The designation of the respondents has no impact on understanding of PCMM Level 3 Key practices.

3) The designation of the respondents has no impact on understanding of PCMM Level 4 Key practices.

4) The designation of the respondents has no impact on understanding of PCMM Level 5 Key practices.

5) There is no significant association between experience of the respondent in the PCMM organization and satisfaction of awareness and training given by the organization about all PCMM levels.

6) There is no significant association between experience of the respondent in the PCMM organization and agreeability about the applicability of PCMM.
7) There are no differences between the level satisfaction of the respondents about individual satisfaction factors in PCMM and Non-PCMM level.

8) The designation of the respondents has no impact on opinion of respondents on execution of key practices of PCMM Level 2 Key process areas in PCMM level organization.

9) The designation of the respondents has no impact on opinion of respondents on execution of key practices of PCMM Level 3 Key process areas in PCMM level organization.

10) The designation of the respondents has no impact on opinion of respondents on execution of key practices of PCMM Level 4 Key process areas in PCMM level organization.

11) The designation of the respondents has no impact on opinion of respondents on execution of key practices of PCMM Level 5 Key process areas in PCMM level organization.

12) There is no correlation between the satisfaction of awareness and training about all PCMM levels and overall satisfaction about PCMM.

13) There is no difference between opinion of the HR professionals about the level of satisfaction of the employees before and after implementation of PCMM.

14) There are no significant differences in the level of organizational improvements (20 factors) before and after the implementation of PCMM.

15) There is no significant agreement between the respondents regarding the ranking of reasons for implementation of PCMM in an organization.
1.5.10 Framework of Analysis

1.5.10.1 Analysis of Data

The data collected through the questionnaire were classified and analyzed through various Statistical tools. Data analysis proves to establish the relationship and the influence of one variable on the other variables. Efforts have also been made to prove the hypotheses framed to solve the research problem.

1.5.10.2 Analytical Tools

The researcher has applied certain Statistical tools to analyze the primary data collected from the respondents. Tools such as Frequency Distribution, Bar Charts, Cross Tabulations, and Histograms are used to classify and show the data distribution among the various criteria. Also statistical tools like Paired t-test, Chi-square Tests, Friedman’s Test, Kendall’s Coefficient of concordance, one way ANOVA, Cluster Analysis, Wilcoxon Matched Pair Test, Factor analysis and Karl Pearson’s Correlation analysis were used to analyze the data and bring out the significant relationship between the variables. Computerized Statistical Packages like SPSS and MS Excel were found to be of immense help for better analysis and accurate results.

a. Frequency Distribution

Frequency Distribution refers to data classified on the basis of some variable. The term variable refers to the characteristic that varies in amount or magnitude. In a frequency distribution a variable may be either continuous or discrete.

b. Cross tabulations

Cross tabulations are used for research studies with variables composed of category data, to inspect the relationships between and among those variables. Cross tabulation is a technique for comparing two classification variables. It uses tables
having rows and columns that correspond to the levels or values of each category of variables\textsuperscript{12}.

c. T-test

A t-test is used to determine whether there is a significant difference between two sets of scores for each of composite variables\textsuperscript{13}. This is evaluated by comparing mean scores of two groups\textsuperscript{14}. There are two types of t-test (independent samples and dependent samples); here the dependent sample t test (paired t test) was used. Sample size is another influencing factor that determines whether a t-test should be applied in this research. Argyrous has stressed that t-scores are correct in both large and small sample cases whereas z-scores are correct only in a large sample. In addition, the sample size of 30 has much ‘fatter tails’ in t-distribution than z-distribution, these tails become thinner in a sample size of 90, and it eventually becomes identical to a normal curve when a sample size is greater than 120\textsuperscript{15}.

d. Chi-square Test

A number of tests are available to determine if the relationship between two cross tabulated variables is significant. One of the popular tests is chi-square. One of the advantages of chi-square test is that it is appropriate for almost any kind of data\textsuperscript{16}. Testing of hypotheses has been taken up with the help of Chi-square test. Chi-square test is based on the chi-square distribution. As a parametric test it is used for comparing a sample variance to a theoretical population variance\textsuperscript{17}.

e. ANOVA

Analysis of variance, or ANOVA, is a method of testing the null hypothesis that several group means are equal in the population, by comparing the sample variance estimated from the group means to that estimated within the groups.
i. One way ANOVA

This particular design used when there is only one categorical independent variable and one dependent variable. Each category of an independent variable is called a level. In this type of design we randomly allocate the various sampling elements to the different levels of the independent variable and measure the resulting dependent variable.

ii. A Randomized Block Design

A Randomized Block Design is used if there is an additional variable (Call the Block) which has an impact on the relationship between the independent and dependent variables. This variable is accounted for in the design of randomized block design by explicitly changing the levels of the block and testing if that has impact on the relationship between the independent and dependent variable.

iii. Factorial Design

If two or more independent variables are to be tested through an ANOVA we use a factorial design, because each independent variable in ANOVA is also known as a factor. The factorial Design can accommodate several factors independent variables at several levels of categories each. The major difference in analyzing factorial design with two or more factors is that interaction of two or three factors among themselves form a separate effect^{18}.

f. Karl Pearson’s Coefficient of Correlation

It is used to ascertain the significant relationship between the selected two variables. Karl Pearson’s Coefficient of Correlation is based on the following assumptions:

i) There is a linear relationship between the variables.
ii) The two variables under study are affected by the large number of independent causes so as to form a normal distribution.

iii) There is a cause and effect relationship between the forces affecting in the distribution of the items in the two series. If such a relationship is not formed between the variables there cannot be any correlation\(^\text{19}\).

g. **Kendall's Coefficient of Concordance (Kendall’s W)**

This test is a nonparametric test of the hypothesis that tests several related samples from the same population which measures the agreement of raters. Each case is a judge or rater and each variable is an item or person being judged. For each variable, the sum of ranks is computed. Kendall's W ranges between 0 (no agreement) and 1 (complete agreement)\(^\text{20}\).

h. **Friedman Test**

Friedman Test is to test the null hypothesis that k related variables come from the same population. For each case, the k variables are ranked from 1 to k. The test statistic is based on these ranks\(^\text{21}\).

i. **Wilcoxon Matched Pair test**

The Wilcoxon test is a nonparametric test that compares two paired groups. It calculates the difference between each set of pairs, and analyzes that list of differences. The P value answers this question: If the median difference in the entire population is zero (the treatment is ineffective), what the chance that random sampling would result in a median as far from zero (or further) as observed in this experiment is.

In calculating the Wilcoxon test, Prism first computes the differences between each set of pairs, and ranks the absolute values of the differences from low to high. Prism then sums the ranks of the differences where column A was higher (positive
ranks), sums the ranks where column B was higher (it calls these negative ranks), and reports the two sums. If the two sums of ranks are very different, the P value will be small. The P value answers this question: If the treatment really had no effect overall, what the chance that random sampling would lead to a sum of ranks as far apart (or more so) as observed here is.

If your samples are small and there are no tied ranks, Prism calculates an exact P value. If your samples are large or there are tied ranks, it calculates the P value from a Gaussian approximation. The term Gaussian, as used here, has to do with the distribution of sum of ranks, and does not imply that your data need to follow a Gaussian distribution$^{22}$.

**j. Factor Analysis**

Factor analysis is a very useful method of reducing the complexity by reducing the number of variables being studied. In a more general way, factor analysis is a set of techniques which, by analyzing correlations between variables, reduces their number into fewer factors which explain much of the original data, more economically. There are two stages in factor analysis.

**Stage 1 – Factor extraction process**

Here our objective is to identify how many factors will be extracted from the data. The most popular method is called Principal component analysis. There is also a rule of thumb based on the computation of an Eigen value, to determine how many factors to extract. The higher the Eigen value of a factor, the higher is the amount of variance explained by the factor.
**Stage 2 – Rotation of Principal component**

After the number of extracted factors is decided upon in stage 1, the next task is to interpret and name the factors. This is done by the process of identifying which factors are associated with which of the original variables. The factor matrix is used for this purpose. The original factor matrix is un-rotated, and is a part of the output from stage 1. The rotated factor matrix comes about in stage 2 and gives as the loading of each variable on each of the extracted factors. Value close to ‘1’ represents high loadings and that close to ‘0’, low loadings. The objective is to find variables which have a high loading on one factor, but low loading on other factors.

**k. Cluster Analysis**

The term *cluster analysis* does not identify a particular statistical method or model, as do discriminant analysis, factor analysis, and regression. You often don’t have to make any assumptions about the underlying distribution of the data. Using cluster analysis, you can also form groups of related variables, similar to what you do in factor analysis. There are numerous ways you can sort cases into groups. The choice of a method depends on, among other things, the size of the data file. Methods commonly used for small data sets are impractical for data files with thousands of cases. SPSS has three different procedures that can be used to cluster data: hierarchical cluster analysis, $k$-means cluster, and two-step cluster. If you have a large data file (even 1,000 cases is large for clustering) or a mixture of continuous and categorical variables, you should use the SPSS two-step procedure. If you have a small data set and want to easily examine solutions with increasing numbers of clusters, you may want to use hierarchical clustering. If you know how many clusters you want and you have a moderately sized data set, you can use $k$-means clustering.
Hierarchical Clustering

There are numerous ways in which clusters can be formed. Hierarchical clustering is one of the most straightforward methods. It can be either agglomerative or divisive. Agglomerative hierarchical clustering begins with every case being a cluster unto itself. At successive steps, similar clusters are merged. The algorithm ends with everybody in one jolly, but useless, cluster. A divisive clustering start with everybody in one cluster and ends up with everyone in individual clusters. Obviously, neither the first step nor the last step is a worthwhile solution with either method.

In agglomerative clustering, once a cluster is formed, it cannot be split; it can only be combined with other clusters. Agglomerative hierarchical clustering doesn’t let cases separate from clusters that they’ve joined.

To form clusters using a hierarchical cluster analysis, you must select:

- A criterion for determining similarity or distance between cases
- A criterion for determining which clusters are merged at successive steps
- The number of clusters you need to represent your data.

K-Means Clustering

Hierarchical clustering requires a distance or similarity matrix between all pairs of cases. That’s a humongous matrix if you have tens of thousands of cases trapped in your data file. Even today’s computers will take pause, as will you, waiting for results. A clustering method that doesn’t require computation of all possible distances is k-means clustering. It differs from hierarchical clustering in several ways. You have to know in advance the number of clusters you want. You can’t get solutions for a range of cluster numbers unless you rerun the analysis for each different number of clusters. The algorithm repeatedly reassigns cases to clusters, so the same case can move from cluster to cluster during the analysis. In agglomerative hierarchical
clustering, on the other hand, cases are added only to existing clusters. They’re forever captive in their cluster, with a widening circle of neighbours.

The algorithm is called $k$-means, where $k$ is the number of clusters you want, since a case is assigned to the cluster for which its distance to the cluster means is the smallest. The action in the algorithm centers on finding the $k$-means. You start out with an initial set of means and classify cases based on their distances to the centers. Next, you compute the cluster means again, using the cases that are assigned to the cluster; then, you reclassify all cases based on the new set of means. You keep repeating this step until cluster means don’t change much between successive steps. Finally, you calculate the means of the clusters once again and assign the cases to their permanent clusters.

**Two-Step Cluster**

When you have a really large data set or you need a clustering procedure that can rapidly form clusters on the basis of either categorical or continuous data, neither of the previous two procedures fills the bill. Hierarchical clustering requires a matrix of distances between all pairs of cases, and $k$-means requires shuffling cases in and out of clusters and knowing the number of clusters in advance. The SPSS Two-step Cluster Analysis procedure was designed for such applications. It requires only one pass of data (which is important for very large data files), and it can produce solutions based on mixtures of continuous and categorical variables and for varying numbers of clusters. The clustering algorithm is based on a distance measure that gives the best results if all variables are independent, continuous variables have a normal distribution, and categorical variables have a multinomial distribution. This is seldom the case in practice, but the algorithm is thought to behave reasonably well when the assumptions are not met. Because cluster analysis does not involve hypothesis testing
and calculation of observed significance levels, other than for descriptive follow-up, it’s perfectly acceptable to cluster data that may not meet the assumptions for best performance. Only you can determine whether the solution is satisfactory for your needs.

1.6 LIMITATIONS OF THE STUDY

Like other social research, this research also has the following inherent limitations:

1. This study was restricted to PCMM level 5 companies in Chennai city. Hence the study findings could entirely be applicable to PCMM level 5 companies only. It might be generalized to the other PCMM level companies based on their effectiveness of execution of key practices in each level.

2. This study was restricted to software Industry. It might be generalized to the other industries based on the industry structure only.

3. Since the area of research is of a new orientation, the availability of literature for People Capability Maturity Model is limited, with which the researcher has tried to bring out his focus on the research problem.
1.7 OUTLINE OF THE THESIS

The study report has been organized into seven chapters.

The research Thesis has been prepared keeping in mind the standards followed at various Institutions. The Thesis is adequately divided into different chapters, based on the subject matter to be discussed under each chapter. Each chapter in the thesis gives a vivid picture on the topics in such a manner that the research objectives are clearly established.

The outline of the thesis is as follows:

**CHAPTER ONE** deals with the Introduction part of the study, the Need, Scope, and Significance, Objectives of the study and the Research Methodology.

**CHAPTER TWO** discusses about the overview of PEOPLE CAPABILITY MATURITY MODEL in detail forming the basis for the study area. It includes the need for PCMM, different maturity levels and process areas.

**CHAPTER THREE** focuses on the profile of Indian Software Industry. It consists of history of Indian Software Industry, reasons for the growth of Indian Software Industry, quality aspects and the impact of software industry on Indian economy. It also discusses future of Indian Software Industry.

**CHAPTER FOUR** briefs the Review of Literature to the study with References in order to support the current research with the previous research findings.

**CHAPTER FIVE** analyses the effectiveness of Key practices of PCMM.

**CHAPTER SIX** analyses the impact of PCMM on organization level.

**CHAPTER SEVEN** deals with the summary of Research Findings, the Recommendations and Conclusion part along with the future directions of the study.
References:


21. Tutorial – Friedman’s Test Defined, SPSS 13.0 for Window.

