CHAPTER 4

STUDY OF PERFORMANCE OF ERP SYSTEM IN SELECT INDIAN MANUFACTURING FIRMS: RESEARCH METHODOLOGY

4.1 Introduction
The present study is an attempt to examine the impact of ERP system implementation on the change in performance of the manufacturing firm, in the Indian context. This research is a cross-sectional study that used the survey methodology to collect data from Select Indian manufacturing firms belonging to various industries. This chapter discusses the research methodology of the study. It explains the scope, objectives, sample and significance of the study. The statistical techniques used to analyze the data and limitations of the study have also been discussed.

4.2 Performance Measurement of ERP System in Manufacturing Firms
As discussed in chapter 1 it is difficult to calculate the Return on Investment (ROI) for ERP decisions, though several successful installations of ERP had dramatic returns on investment. It has been realized that ERP is only an enabler. ERP gives agility to organization which can be exploited to improve profitability, market share or customer service. Without ERP, the organization may not be in a position to handle a larger business or provide faster response to customers. The result from enlarged business or faster customer response should pay back for the ERP investment. It is predicted on the fact that the organization would leverage the agility towards such corporate goals. ERP helps in pursuing such goals often successfully. But mere ERP implementation does not necessarily translate the benefits. Better health enables a human being to do things which would have been difficult, if not impossible without such sound health. But if the individual does not make use of his/her improved status towards the pursuits of any goal he/she are not capitalizing on the improved health. ERP must also be viewed as a way of providing better health to an organization

1
The benefits from ERP come in three different forms i.e. in the short term, medium term and long term. When initially implemented in a year of organization going live with ERP, it helps in streamlining the operational areas such as purchase, production, inventory control, finance and accounts, maintenance, quality control, sale and distribution etc. This benefit is the form of ‘automating’ the transactions which promises accuracy, reliability, availability and consistency of data. The next level of benefits accrues in the medium term after the data in the above area are in place. At this stage, the organization not only gets data but can use it for more meaningful analysis and plan for major resources (material, machine capacity, manpower, and money). At this stage, the organization realizes benefits in terms of reduced working capital (inventory and receivables), better financial forecasts, reduced cycle time for order fulfillment, improved co-ordination between various related processes in the organization etc.²

The real benefits of ERP comes in the long-term when the organization is in a position to apply the experience of the best business process involved over years of implementing the ERP for other organizations. At this stage the organization adopts the best business practices such as Total Quality Management (TQM), Just-In-Time (JIT) and Computer – Integrated Manufacturing (CIM). In the long-term ERP also enhances the organization’s competitive edge by providing it the ability to change easily. An ERP package provides various ways of performing a business activity, and an organization can adopt a different way of performing the same activity by re-configuring the ERP and testing the changes³.

Al-Mashari et al⁴. (2003) classifies changes in performance measures due to ERP system implementations into five categories. The operational category concerns improvements in functional areas leading to cost reductions, cycle time reductions, and productivity improvements. Benefits such as better resource management, improved decision-making, planning, and performance improvements fall into the managerial group. Strategic benefits help firms to innovate, build cost leadership, generate product differentiation, and build external links in the supply chain. The firm’s IT infrastructure benefits through IT cost reductions and increased IT capacity. Organizational benefits such as business learning and successful organizational changes also accrue to firms⁵.
In an effort to ensure successful ERP system implementations, Chen\textsuperscript{6} (2001) emphasizes effective management of all ERP system issues, from the pre-implementation to the post implementation stages. He suggests that firms focus on issues such as assessing needs and choosing the right ERP system, aligning their business processes to the ERP system, and use CSFs such as top management support, implementation team, user support, culture changes, and continuous learning to facilitate the implementation process. He further suggests that firms which effectively use their ERP system can leverage information output and experience early efficiency gains. Firms can then consolidate their implementations to achieve enhanced benefits.

4.3 Research Problem
There are very few studies (e.g. Sedara et al. 2002, Gable \textit{et al.} 2003, Sedara \textit{et al.} 2004, Ifinedo 2006) related to foreign countries and one by Madapusi (2008) related to Indian firms that evaluate the varying performance benefits flowing from different ERP system implementations as well as investigating the impact of CSFs on the ERP system deployment process. Therefore need for research was felt in this area. The study is embodied as “Study of Performance of Enterprise Resource Planning System in Select Indian Manufacturing Firms”

4.4 Objectives of the Study
Objectives of the Study are as under:
1. To study the related literature on ERP success measurement in post implementation stage of life cycle of ERP.
2. To seek empirical evidence of the relationship of ERP modules as an individual module and holistic system on various areas of performance of the firm by intermediating CSFs in the post implementation stage of ERP system.

Research questions addressed in this study are:
(1) What are the modules that comprise an ERP system?
(2) What are the CSFs that impact ERP system implementations?
(3) What are the changes in performance that result from ERP system implementations?

(4) Does a relationship exist between the implementation status of the ERP system and changes in performance?

(5) Does a holistic ERP system provide changes in performance?

(6) Do CSFs influence the relationship between the implementation status of the ERP system and changes in performance?

The first three research questions 1, 2 & 3 are addressed in the literature review and question number 4, 5 & 6 are empirically tested by collecting primary data which is discussed later on.

4.5 Hypotheses of the Study

To answer research question 4, 5 & 6 and to study the ERP System Implementation Status and Change in Performance ERP system model is investigated by framing and testing the first set of research hypotheses – 1a and 1b – in this research study.

For research question 4 the following null hypotheses was determined.

Null Hypotheses 1a
Ho1a: The implementation status of individual ERP system modules does not contribute to changes in performance.

Research Hypotheses 1a
H1a: The implementation status of individual ERP system modules contribute to changes in performance.

For research question 5 the following null hypotheses was determined.

Null Hypotheses 1b
Ho1b: The implementation status of a holistic ERP system does not contribute to changes in performance.

Research Hypotheses 1b
H1b: The implementation status of a holistic ERP system contributes to changes in performance.

To study the influencers of ERP System Implementation Success ERP system implementation model is investigated by testing the second set of research hypotheses – 2a and 2b – in this research study.

For research question 6 the following set of null hypotheses was determined.

Null Hypotheses 2a
Ho2a: CSFs does not moderate the relationship between the implementation status of individual ERP system modules and changes in performance.

Research Hypotheses 2a
H2a: CSFs moderate the relationship between the implementation status of individual ERP system modules and changes in performance.

Null Hypotheses 2b
Ho2b: CSFs does not moderate the relationship between the implementation status of a holistic ERP system and changes in performance.

Research Hypotheses 2b
H2b: CSFs moderate the relationship between the implementation status of a holistic ERP system and changes in performance.

4.6 Data Collection Instrument
The data collection instrument, in the form of a survey questionnaire developed and used by Madapusi (2008), which is based on earlier research studies, with few changes, is used for data collection. Changes to the questionnaire are done on the basis of review of literature done mostly from studies available from the year 2004 to 2011. Few studies prior to year 2004 are also considered. Madapusi (2008) had recognized 14 critical success factors based on which his questionnaire was designed. In the present study, on basis of in-depth study of literature, 3 more critical success factors were recognized and
inclusion of them was done in the questionnaire, which are tabulated in table 3.29 and discussed in section 3.3.3.

Thus the survey questionnaire finalized consist general information about the firm based on 14 modules, 17 critical success factors and 10 areas of performance measures. There are 9 questions based on the demographic profile of the company, 23 questions with 7 point Likert scale based on the ERP system implemented in the firm and 4 questions based on the respondent personal details.

4.7 Sources of Data
The empirical study is based on primary data collected by way of survey questionnaire from Select Indian manufacturing firms belonging to various industries. These firms belong to various manufacturing zones from South Gujarat, Maharastra, Noida, Chandigarh, Punjab and Haryana, profile of which is given in section 5.2.2

4.8 Sample of the study
For the present study only Select Indian manufacturing firms are considered. Therefore survey questionnaire was sent to selected Indian manufacturing firms. Majority of the questionnaires were sent to the respondent in physical format while some questionnaires were sent in electronic format. Few firms were mailed soft copy of the questionnaire whereas online questionnaire was also designed and hosted for the ease and convenience of the respondent. The survey questionnaire was forwarded to around 250 respondents. 122 duly filled questionnaires were received which became the sample for the present study.

4.9 Data Analysis
The questions addressed in the present study tries to define the relationship of the ERP system modules implemented with the performance of the firm considering the moderating effect of critical success factors (CSFs). ERP modules implemented by each firm were key variables which are treated as independent variables, performance measures were treated as dependent variables and critical success factors as moderating
variables in the study. The modules, performance measures and CSFs are measured on the basis of their mean values (M) and standard deviation (SD). Cronbach’s Alpha & Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett’s test of sphericity is used to measure the reliability of the data. Factor analysis technique is applied on the modules (independent variables), performance measures (dependent variables), and critical success factors (intervening variables). Principal Component Analysis with Varimax Rotation method is employed for extracting the factors. To address the problem of multicollinearity, correlations analysis is applied. Statistical tools like multiple linear regression analysis and univariate ANOVA are applied on the data for acceptance or rejection of the hypotheses. The data relating to demographic profile, of the company and the respondent, is analysed using mean, standard deviation and by applying frequency analysis. For processing the data Statistical Package for the Social Sciences (SPSS) 16.0 is employed.

4.10 Limitations of the study
Every research work is subjected to certain limitations; and this study is also not an exception.

The present study has the following limitations:

1. The responses for the study have been solicited from few ERP users. The expectations and experience of the may vary from those of the rest ERP users in India.

2. The present study is based on primary data collected from the internal stakeholders of the firms; therefore it is based on the personal responses given by the respondent, which may be biased.

3. The present research explores the key dimensions on which the overall ERP performance is measured. In all 17 critical factors, 14 ERP modules and 10 performance measures are considered in the present study. Although an attempt has been made to extensively identify the attributes of the possible performance measures, yet there is possibility of missing the key dimensions that may be considered as an ERP performance measure by ERP users.
4. Convenient sampling method is used for data collection and therefore the results cannot be generalised.

4.11 Chapter Concluding Notes

This chapter described the research methodology used in the present study. The next chapter discusses the findings of the empirical study.

END NOTES


3 Ibid


5 Madapusi (2008), *op. cit.*, Pg 107-108