AN EXPLORATORY CASE STUDY ON PERFORMANCE ENHANCEMENT OF ERP PROJECTS

[1]S. Parthasarathy, [2]N. Anbazhagan, [3]Muthu Ramachandran

[1]Dept. of Computer Science & Engineering, Thiagarajar College of Engineering, Madurai, India
[2]Dept. of Mathematics, Thiagarajar College of Engineering, Madurai, India
[3]School of Computing, Leeds Metropolitan University, United Kingdom
[1]partha_s79@yahoo.com, [2]anbazhagan_n@yahoo.co.in, [3]m.ramachandran@leedsmet.ac.uk

Abstract. Business information system is an area of the greatest significance in any business enterprise today. Enterprise Resource Planning [ERP] projects are a growing segment of this vital area. These software systems are designed and installed by ERP vendors. Most current research on the subject concerns only managerial issues. This study is to probe the performance of ERP software in terms of the three crucial technical factors that determine the success or failure of a given ERP software. To probe these research issues, an exploratory case study was conducted with a survey and interview at a large organization with an ERP system. The statistical analysis of the collected data supports the three hypotheses of the study, leading to the conclusion that the crucial technical factors for ERP implementation are the same in literature and in the companies with successful ERP implementation. The future research study will involve other technical aspects of ERP implementation for enhancing its performance.

Keywords: ERP implementation, customization, performance, metrics and information systems.

(Received June 15, 2006 / Accepted September 25, 2006)

1. INTRODUCTION

Enterprise systems are complex and expensive and create dramatic organizational change. Learning from high performance projects is crucial for software process improvement. Last, but not least, by determining the crucial factors of successful ERP system, we create incentives that likely will yield higher performance. Indeed, Weinberg [41] demonstrated many years ago that the proverb "You get what you measure" also is highly valid in the software engineering field. ERP projects are a subclass of software projects [15].

In this paper, we find the crucial technical factors determining the performance of ERP projects and recommend it as performance indicator. According to a report by Advanced Manufacturing Research (AMR) obtained from www.amrresearch.com, the ERP software market is expected to be $31 billion by the end of 2006. From [43], we find that the entire enterprise applications market which includes Customer Relationship Management (CRM) and Supply Chain Management (SCM) software will top $70 billion. Many researchers and practitioners have suggested that it is easier and less costly to mold business processes to ERP systems rather than vice versa [11] [20].

ERP is packaged software that organizes codes and standardizes an enterprise's business processes and data. This packaged software converts transactional data into useful information and collates the data so that they can be analyzed and used for decision making by the top management. Many company ERP products developed in the 1990s have enabled companies to redesign their business processes and eliminate duplications. Hence the employees were able to focus on process design value-adding activities that have dramatically increased productive capacity.

The difficulties and high failure rate in implementing ERP systems have been widely cited in the literature [11], but research on critical success factors in ERP implementation is rare and fragmented. To date, little has been done to theorize the important factors for initial and ongoing ERP implementation success [8]. Enterprise Resource Planning (ERP) systems [16] have emerged as the core of successful information management and the enterprise backbone of organizations. An enterprise resource planning (ERP) system is a packaged business

software system that enables a company to manage the efficient and effective use of resources by providing a total, integrated solution for the organization's information-processing needs. It supports a process-oriented view of the business as well as business processes standardizes across the enterprise [16].

ERP implementation is a lengthy and complex process and there have been many cases of unsuccessful implementations which have had major impacts on business performance [31]. As ERP plays a very important role in business, ERP implementation and its critical issues, success factors and implementation problems have been identified in [29] [38], but no empirical studies and no explicit proposition is being evaluated so far.

Three possible hypotheses with which to examine the crucial technical factors determining the performance of ERP projects is presented in this paper. ERP applications evolved into applications capable of linking all internal transactions [19]. Even for those companies that have successfully implemented large-scale information systems projects in the past, ERP implementation still presents a challenge, because it is not simply a large-scale software deployment exercise [42].

The development, implementation and ownership of information systems, especially large-scale systems such as enterprise resource planning (ERP) has become progressively longer in duration and more cost intensive [26]. One study of mid-size to large companies conducted by AMR found that 67% of these companies are implementing some form of ERP, while another 21% are evaluating potential ERP systems solutions.

As a growing number of companies adopt ERP systems, performance of ERP systems are identified as one of the top five IT priorities among global CIOs according to independent surveys conducted by Morgan Stanley [39] and Deloitte & Touche/IDG Research Services Group [1].

Though there are many critical success factors found already for ERP implementation, all of them address only managerial issues and could not bring much impact on performance of ERP software. Hence this studies to establish three crucial technical factors determining the performance of ERP software from the literature.

An exploratory case study was conducted to study these research issues. The case study consisted of a survey and interview of 25 employees at one large organization those who have recently implemented SAP R/3 successfully. SAP (Systems, Applications and Products in Data Processing) is a leading ERP vendor. SAP R/3 product is the first three-tiered client/server enterprise resource planning (ERP) software released by SAP.

The results provide data analysis and findings from the survey and qualitative findings from the interview. Three hypotheses were formulated and statistical techniques were used to analyze the hypotheses. The statistical analysis gives a great deal of support to all the three hypotheses. This gives a conclusion that the crucial factors for ERP implementation are one and the same in literature and the companies with successful ERP implementation. Thus, it is evident that these factors will ensure the performance of ERP projects. This paper is organized as follows. Literature review of ERP systems, research study, exploratory case study, testing the hypotheses, data analysis and findings, conclusions and future research work.

2. LITERATURE REVIEW

Customizations that must be carried over from one version of enterprise software to the next are the biggest technology headache [33]. The fit between the business processes and ERP systems and among business processes is believed to be critical success of ERP implementation [20], [21], [30], [40]. This is termed as "Customization". It is observed that higher the degree of customization, lower will be the performance of ERP projects. Defining business requirements and then determining how to configure them into the software is an iterative process [12].

Avoiding more drastic forms of customization are critical because changes move the system away from a packaged solution—and the organization away from the enterprise system benefits it seeks to achieve. Also, technical changes are costly and can lead to schedule slippage because they are complex and need significant testing. In addition, the team must reimplement them for each package release, which increases long-term maintenance costs. Hence customization is considered as the first crucial technical factor for ERP performance.

ERP is developed for a market and not for an organization alone and hence its performance matters a lot [10] [27] [35]. It is observed in [6] [11] [17] that the customization determines the performance of ERP software. This tells us that ERP systems need to be changed to fit existing or reengineered business processes. The adaptation of the ERP systems involves the

customization of ERP system to fit existing or reengineered business processes.

Metrics are units of measurement. Software engineering metrics are units of measurement that are used to characterize the software engineering products and software engineering processes. The term "metrics" [32] is also frequently used to mean a set of specific measurements taken on a particular item or process. If used properly, software engineering metrics allow us to

(i) Quantitatively define success and failure, and/or the degree of success or failure of a product;

(ii) Identify and quantify improvement, lack of improvement, or degradation in our products and processes;

(iii) Make meaningful and useful managerial and technical decisions.

Thus, effective usage of software metrics for software process improvement in ERP projects is the second factor deciding its performance.

Wenhong Luo and Diane M. Strong [42] says that there is a need for separate set of process approach and metrics for ERP projects as the difference between ERP and traditional information system development project is that ERP projects, which tend to be enterprise-wide, are typically larger in scope than traditional software development projects, which often focus on one or more business processes. The risks associated with the ERP projects are relatively higher than those traditional projects [2]. Software metrics leads to software process improvement (SPI).

SPI has emerged as a critical factor for an organization involved in software development. Various organizations have reported benefits from software process improvement programs and now there is little doubt that process improvement can pay rich dividends [3] [9] [13] [23]. Software metrics and measurements have been an area of active interest for a long time. One of the main objectives of the area has been to quantify properties of interest in the process of the products, with the goal that these can used to evaluate and control the products and processes.

Though metrics can be used in many ways, in a software organization, the three main uses of metrics data are: project planning, monitoring and controlling a project, and overall process management and improvement. In any organization, past experience plays a key role in improvement and management. How effectively past experience can be leveraged depends on how well this experience is captured and organized to enable learning and reuse.

Systematically recording data from projects, deriving lessons from it, and then making the lessons available to other projects will enhance the performance of the project. This can be done through process database. ERP project, being a large scale software project can improve its performance by effectively utilizing the process database. Hence, the third factor determining the performance of ERP projects is process database.

The process database is a repository of process performance data from successful projects, which can be used for project planning, estimation, analysis of productivity and quality and other purpose [18]. The process database consists of data from successfully completed projects and forms the quantitative knowledge about experience in project execution. As can be imagined, to populate the process database, data is collected in projects, analyzed and then organized for entry into the process database [22].

The data captured in the process database can be classified into the following categories: Project characteristics, Project schedule, Project effort, Size and Defects [24] [25]. The Capability Maturity Model (CMM) requires that the organization have a process database which is used for planning, though CMM does not specify what this process database contains.

ERP implementation is viewed as a long and complex process with successes and failures at different stages of the implementation. In a study of ERP implementation in 15 different companies, Ross [34] discovered that most companies go through the following five stages in their implementation process: design, implementation, stabilization, continuous improvement, and transformation. The system development lifecycle methodology needs to be modified for the unique characteristics of ERP implementation [6] [37].

ERP is a structured approach to optimize a company's internal value chain. When the software is fully installed across an entire company, it connects the components of the business process through a logical transmission and sharing of common data within an integrated framework.

Hence the performance of ERP matters the performance of the company. This is the motivation for this exploratory case study on performance enhancement of ERP projects. Also we find that most of research work addresses only managerial issues and less research work has been carried

out to address ERP implementation from technical perspective.

From this literature review, we find that the three factors that acts as the crucial parameters deciding the performance of ERP projects are customization, software metrics and process database. Rest of sections in this paper will validate these factors with the data collected from large scale company with successful ERP system.

3. RESEARCH STUDY

As stated earlier, our research focus on validating the crucial technical factors determining the performance of ERP projects namely (i) customization (ii) software metrics for software process improvement and (iii) process database with the companies executing successful ERP system. This is done by testing the following three hypotheses and analyzing it using the data collected from the survey.

Hypothesis 1 (H1): Higher the degree of customization, lower will be the performance of ERP projects.

Hypothesis 2 (H2): Software metrics leads to software process improvement for ERP projects.

Hypothesis 3 (H3): Effective usage of process database leads to successful ERP implementation.

The survey questions for testing these hypotheses are given in Appendix 1. The first hypothesis deal with the role of customization in determining the performance of ERP software. The primary goal of customization in ERP implementation is to achieve a fit between the ERP system and the process that the system supports. Thus, both the system and the process can be changed or customized to achieve the goal. When the system is customized to fit the process, we refer to this kind of customization as technical customization [42]. Similarly, when a process is customized to fit the system, we refer it as process customization [42].

When installing an ERP system, companies have many choices about how to change and customize the software package [6]. There is also a case where there will be no need for customization. This can be achieved by selecting appropriate system modules. Although rare, it is still possible. For example, Thermacore decided to implement SAP's accounting module without any changes [14].

The second hypothesis is formulated to stress the fact identified from the literature that effective usage of software metrics leads to software process improvement which in turn brings high performance to the ERP projects. Software process improvement helps to keep track of the project by establishing checkpoints for project planning, monitoring and controlling. Developing and using an exclusive set of metrics for ERP projects will enhance its performance and traditional metrics cannot create much impact on large scale IT projects like ERP projects [15].

The third hypothesis is formulated to test the effect of process database in improving the performance of ERP projects. We consider a process database in an organization as a database or collections of databases that contains historical information and data about the use of organization processes on completed software projects. This process database created for ERP projects will provide details on previously completed projects such as project size, duration, scheduling, effort required, defects expected and risk factors.

4. EXPLORATORY CASE STUDY

A case study was conducted at Company X. X is a manufacturer involved in SAP implementation. The survey was conducted with the employees in the technical as well as managerial position, who were employed during SAP implementation and the members of ERP vendor SAP deputed to the X for ERP implementation. These employees were working with this ERP system in their day-to-day job. In addition to the survey, informal interviews were conducted to collect additional details. It is found that for just an ERP implementation in time, managerial issues discussed already will do, but for reaping the full benefits of the ERP system after implementation, technical factors highlighted in this study plays a crucial role.

5. HYPOTHESES TESTING, DATA ANALYSIS AND FINDINGS

Each of the survey questions for each hypothesis was tested using one sample t test with the null hypothesis being the sample mean is less than or equal to three (neutral, midpoint of the Likert scale in Appendix 1). The alternate hypothesis (at a significance level of 0.025 for one–tail t test) states that the sample mean is greater than three and the respondents agree with the survey questions. Sharma [36] gives the procedure for conducting t test.

Table 1, Table 2 and Table 3 shows the results of the survey for the above stated three hypotheses respectively. All the three tables give a great deal of support to all the

three hypotheses. Figure 1, Figure 2 and Figure 3 indicates that there is a positive climate prevailing for our research study. Hence we find that the technical factors for ERP projects identified from the literature and those in the companies are unique.

Hence we can conclude that addressing these crucial technical factors will definitely bring higher performance to the ERP projects. From the informal interview conduced with the employees, we learn that though the managerial factors like top management involvement, project management, change management, ERP project team, end user training etc influences the ERP implementation, it does not account for failure or performance degradation.

This indicates that the performance of ERP software will improve if technical factors cited here are given much more importance than managerial factors. Hence this study to focus upon the three crucial technical factors for performance enhancement of ERP projects gains energy.

Enterprise resource planning system has the Herculean task of seamlessly supporting and integrating a full range of business processes, uniting functional islands and making their data visible across the organization in real time. Not surprisingly, the software that vendors such SAP and Oracle provide is unwieldy, expensive and hard to implement. Even less surprising is that implementation creates organizational change that can be as painful as, well, pulling teeth.

No package is a perfect fit on all dimensions, so the first part of planning should include a careful analysis to determine how the organization will bridge gaps. Identifying what organizational processes and roles will change and determining how to perform transition into new roles are also important tasks at this stage.

Defining business requirements and then determining how to configure them into the software is an iterative process. During the initial implementation of an ERP system, many organizations choose to customize the standard ERP software modules to meet implementation dates and to match their unique business requirements. Dealing with customization issues during an ERP project requires approximately 80% of a software developer's and 66% of a business analyst's time and effort [33]. Managerial factors are often cited as the reason for ERP failure and only few articles document the actual cause for ERP failure [44].

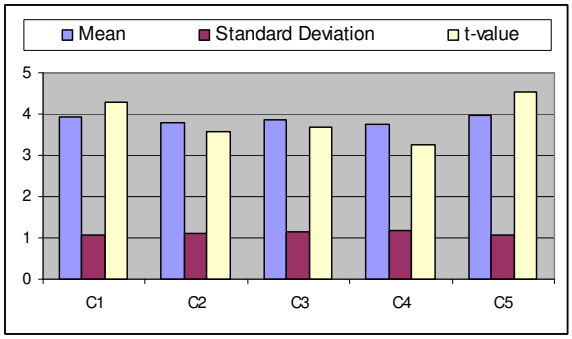

Figure 1 Results of Hypothesis 1

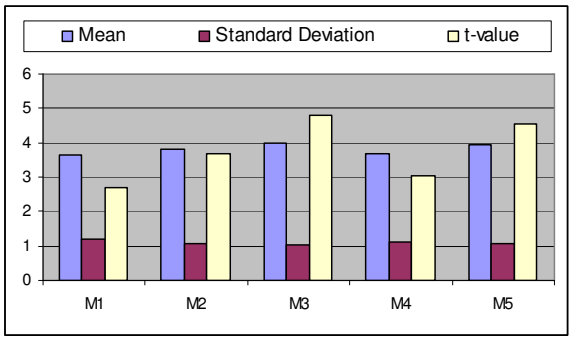

Figure 2 Results of Hypothesis 2

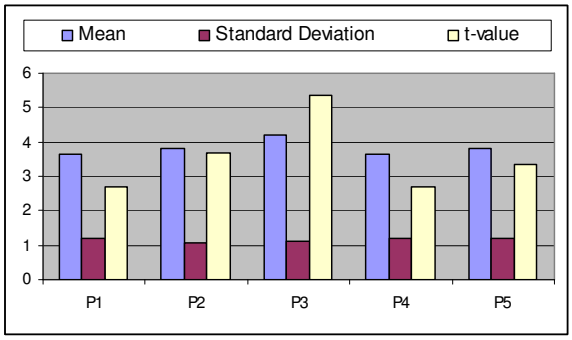

Figure 3 Results of Hypothesis 3

6. CONCLUSIONS

It is hard to find appropriate performance indicators and it may ultimately entail comparing apples and pears. Measuring performance is a difficult task. Ideally, performance assessment should include productivity indicators, quality indicators and other external factors. As ERP projects differ from custom software development (CSD) projects, projecting its performance indicators are little hard and all that we have done in this paper is the validation of crucial technical factors of ERP projects found from the literature than the usual managerial factors.

Survey Questions	Mean	Standard Deviation	t-value	P (t-value) for one-tail test	Result
C1	3.92	1.07703	4.27	0.0001	Reject Null Hyp. Support H1
C2	3.80	1.11803	3.57	0.00076	Reject Null Hyp. Support H1
C3	3.84	1.14309	3.67	0.0006	Reject Null Hyp. Support H1
C4	3.76	1.16476	3.26	0.00165	Reject Null Hyp. Support H1
C5	3.96	1.05987	4.53	0.0001	Reject Null Hyp. Support H1

Table 1: Results of Hypothesis 1

Survey Questions	Mean	Standard Deviation	t-value	P (t-value) for one-tail test	Result
M1	3.64	1.18603	2.70	0.0063	Reject Null Hyp. Support H2
M2	3.80	1.08012	3.70	0.0006	Reject Null Hyp. Support H2
M3	4.00	1.04083	4.80	3.4E-05	Reject Null Hyp. Support H2
M4	3.68	1.10755	3.06	0.002627	Reject Null Hyp. Support H2
M5	3.96	1.05987	4.53	0.001	Reject Null Hyp. Support H2

Table 2: Results of Hypothesis 2

Survey Questions	Mean	Standard Deviation	t-value	P (t-value) for one-tail test	Result
P1	3.64	1.18603	2.70	0.0063	Reject Null Hyp. Support H3
P2	3.80	1.08012	3.70	0.0006	Reject Null Hyp. Support H3
P3	4.20	1.11803	5.36	8E-06	Reject Null Hyp. Support H3
P4	3.64	1.18603	2.69	0.006281	Reject Null Hyp. Support H3
P5	3.80	1.19023	3.36	0.0013	Reject Null Hyp. Support H3

Table 3: Results of Hypothesis 3

Organizations should change their business processes to fit the ERP system, which provides the best practices and avoid customization. The review of case studies of ERP system implementation indicates that, in reality the practice is otherwise. Many articles have come up addressing the managerial issues in ERP implementation. It is necessary to mention here that managerial issues are manageable and ERP failure and its performance upgradtion have to be viewed from the other side. This opened the door for this research study focusing the crucial technical factors for successful ERP implementation and enhancing its performance.

Though ERP is a managerial concept, basically it is packaged software and its failure and performance requires consideration from technical perspective [4]. An exploratory case study was conducted to study this research issues and data analysis done through statistical techniques. The literature review was done meticulously and the crucial technical factors identified from the literature for performance enhancement of ERP projects agree with the factors cited by the ERP team in the industry. The outcome of this paper is establishment of three crucial technical factors to the ERP vendors for performance enhancement of ERP projects.

ERP vendors and organizations in the process of launching ERP should remember to integrate these crucial technical factors with other managerial factors to deliver a quality ERP system on time as well as within budget that will reap the full benefits of packaged software. Validating our results by a multi-organizational case study, considering other technical aspects of ERP implementation like operating system, client-server technology, mainframe technology, reliability and future technology integration are the other areas for future research.

7. REFERENCES

[1] Achieving, Measuring and Communicating IT value, Deloitte Touche and IDG Research Services Group report, 2002.

[2] Applegate L M., McFarlan F W and McKenney J L., "Corporate Information Systems Management: Text and Cases", 5th edition, McGraw-Hill, 1999.

[3] Arthur L J., *Quantum improvement in software system quality, Communications of the ACM*, pp. 47-52, June 1997.

[4] Ben Light, *Potential Pitfalls in Packaged Software Adoption, Communications of ACM,* Vol. 48, No.5, May 2005.

[5] Bingi P., Sharma M K., and Godla J K., *Critical success factors affecting an ERP implementation, Information Systems Management*, 1999.

[6] Brehm L, Heinzl A and Markus M L., *Tailoring ERP systems: A spectrum of choices and their implications, Proceedings of 34th Annual Hawaii International Conference on System Sciences*, 2001.

[7] Brehm L., and Markus M L., *The divided software life cycle of ERP packages, presented at the 1st Global Information Technology Management World Conference,* Memphis, TN, 2000.

[8] Brown C. and Vessey I., *ERP implementation approaches: toward a contingency framework*, *Proceedings of the International Conference on Information Systems*, pp. 411-416, 1999.

[9] Butler K L., "The economic benefits of software process improvement", Crosstalk, pp. 10-19, 1995.

[10] Carmel E and Sawyer S., *Packaged software development teams: what makes them different?, Information Technology People*, Vol. 11, No. 1, pp. 7-19, 1998.

[11] Davenport T. H., "Putting the enterprise into the enterprise system", Harvard Business Review, pp. 121-131, July-August, 1998.

[12] Diane M. Strong, Olga Volkoff, *A Roadmap for Enterprise System Implementation*, *IEEE Computer Society*, 2004.

[13] Diaz M and Sligo J., *How software process improvement helped Motoroal, IEEE Software*, Vol. 14, No. 5, pp. 75-81, 1997.

[14] Engler N., "ERP heats up thermacore", Computer Reseller News, pp. 68-69, 1999.

[15] Erik Stensrud and Ingunn Myrtveit, *Identifying High Performance ERP Projects, IEEE Transactions on Software Engineering,* Vol. 29, No. 5, May 2003

[16] Fiona Fui-Hoom Nah and Janet Lee-Shang Lau, *Critical factors for successful implementation of enterprise systems*, *Business Process Management Journal*, Vol. 7, No. 3, pp. 285-296, 2001.

[17] Glass R L., *Enterprise Resource Planning—Breakthrough and/or term problems*, Database for Advances Information System, vol. 29, No. 2, pp. 14-16, 1998.

[18] Grady R., and Caswell D., "Software Metrics: Establishing a Company-wide program", Prentice Hall, 1999.

[19] Hiquet B and Kelly A. F., "SAP R/3 implementation guide: A manager's guide to understanding SAP", Macmillan Technical, India, 1998.

[20] Holland C. P. and Light B., *A Critical success factor model for ERP implementation*, *IEEE Software*, pp. 30-36, May/June, 1999.

[21] Hong K and Kim Y, *The Critical success factors for ERP implementation: An organizational fit perspective, Information Management*, vol. 40, No. 1, 2002.

[22] Humphrey W., "Managing the software process", Addison-Wesley, 1989.

[23] Humphrey W., Snyder T R., and Willis R R., *Software process improvement at Hughes aircraft, IEEE Software*, pp. 11-23, 1991.

[24] Jalote P., "CMM in Practice, Processes for executing project at Infosys", Addison-Wesley, 1999.

[25] Jalote P., "Software Project Management in Practice", Addison-Wesley, 2002.

[26] Kenneth E Murphy and Steven John Simon, *Intangible benefits valuation in ERP projects, Information Systems Journal*, pp. 301-320, 2002.

[27] Lynch R K., *Nine pitfalls in implementing packaged applications software, Journal of Information System Management*, Vol. 2, No. 2, pp. 88-92, 1985.

[28] Maris G. Martinsons, *ERP in China: One Package, Two Profiles, Communications of ACM*, Vol. 47, No. 7, July 2004.

[29] Markus and Axline S., and Petrie D., and C. Tanis C., *Learning from Adopters' Experience with ERP Problems Encountered and Success Achieved, Journal of Information Technology*, pp. 245-265, 2000.

[30] Markus M L and Tanis C., "The enterprise systems experience-From adoption to success", in Framing the Domains of IT Research:Glimpsing the Future through the Past, R. W. Zmud, Ed. Cincinnati, OH: Pinnaflex Educational Resources Inc., pp. 173-207, 2000.

[31] Parr A and Shanks G., *A Model of ERP Project Implementation, Journal of Information Technology*, pp. 289-303, 2000.

[32] Pressman S., "Software Engineering-A Practioner's Approach", Tata McGraw-Hill, New Delhi, 2001

[33] Robert C. Beatty and Craig D. Williams, *ERP II: Best Practices for Successfully Implementing an ERP upgrade*, *Communications of the ACM*, Vol. 49, No. 3, March 2006.

[34] Ross J., "The ERP Revolution: Surviving versus Thriving", MIT Sloan Working Paper", Center for Information Systems Research, 1998.

[35] Sawyer S., *Packaged software: Implications of the differences from custom approaches to software development, European Journal of Information System*, Vol. 9, pp. 47-58, 2000.

[36] Sharma, Goyal, "Mathematical Statistics", KRISHNA Prakashan Mandir, 1994.

[37] Soh C., Kein S S., and Tay – Yap, *Cultural fits and misfits: Is ERP a universal solution?, Communications of ACM,* Vol. 43, No. 4, 2000.

[38] Sumner M., *Risk Factors in Enterprise-wide/ERP Projects, Journal of Information Technology*, pp. 317-327, 2000.

[39] Togur D M., and Bloomberg, Morgan Stanley E., CIO Survey Series: Release 4.5, Morgan Stanley Research Report, 2003.

[40] Van Everdingen Y., Hilsberg J and Waarts E., *ERP adoption by European midsize companies, Communications of ACM*, Vo. 43, No. 2, 2002.

[41] Weinberg G., "The Psychology of Computer Programming", New York, van Nostrand Reinhold Co., 1971.

[42] Wenhong Luo and Diane M. Strong, *A Framework for Evaluating ERP Implementation Choices, IEEE Transactions on Engineering Management*, Vol. 5, No.3, 2004.

[43] www.amrresearch.com (Used for AMR Report - Advanced Manufacturing Research Report)

[44] Willcocks L P., *The role of the CIO and IT function in ERP, Communication of ACM*, 2000.

APPENDIX—1

1—Strongly Disagree 2—Disagree 3—Neutral 4—Agree 5—Strongly Agree

1. Customization degrades the performance of ERP software **(C1)**
2. Degree of process customization and technical customization must be balanced. **(C2)**
3. Customization involves organizational capability to make necessary system and process changes **(C3)**
4. Customization though unavoidable, must be kept aside as it leads to schedule slippage **(C4)**
5. Customization is complex and expensive and need significant testing **(C5)**
6. Effective usage of software metrics leads to software process improvement **(M1)**
7. Perfectly tuned software process tunes the performance of ERP projects **(M2)**
8. Failure to apply the software metrics leads to poor software project management **(M3)**
9. Metrics infrastructure will reduce the defects and risks and ensure productivity **(M4)**
10. Software metrics acts as a performance indicator for ERP projects **(M5)**
11. Process database is a must for large scale software projects like ERP projects **(P1)**
12. Process database is essential to quantitavely monitor and control ERP project **(P2)**
13. Process database enables ERP team to determine their process capability **(P3)**
14. Process database is an excellent tool for building a knowledge base for ERP projects **(P4)**
15. Managerial factors decide the successful ERP implementation and technical factors decide the performance of large scale information system projects like ERP project. **(P5)**