



A Framework for Analyzing the Adoption of Enterprise Resource Planning Systems in Indian Organizations

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ABSTRACT

The first ERP systems were introduced in Indian organizations in the late 1990's. The ERP segment in India grew by 23 percent during 1999-2000, and at the end of 2000, more than 200 organizations had either implemented ERP software or were in the process of doing so. Yet, there are no empirical studies or conceptual frameworks within which the experiences of Indian organizations with ERP can be analyzed. This paper proposes a three-stage model for analyzing the deployment of ERP in Indian organizations. Each stage describes a specific aspect of the implementation exercise, and can be used to guide the implementation process. The characteristics of each stage and their implications for managers have also been discussed. The model is based on an empirical study of 25 ERP implementation exercises carried out in organizations from 10 industries.

INTRODUCTION: ERP IN INDIA

The first ERP systems were adopted in India in the late 1990's. As of 1999, ERP systems were functioning in about 100 sites. Among organizations having more than 500 employees, 40 per cent had already implemented an ERP solution while 21 per cent were in various stages of implementation. The ERP segment (software products and consulting services) grew by 17 percent during 1997-1998 and by 23 percent during 1999-2000. This growth is attributable to two reasons. Firstly, the back-end infrastructure required for carrying out electronic business can be provided very effectively by an ERP package, and many companies with plans for e-business find it convenient to first implement an ERP solution. Secondly, between 1998 and 2000, a few Indian software companies started providing ERP solutions, which were less expensive than those of the bigger and more well known companies. Hence many organizations, especially in the SME segment could buy and deploy enterprise systems at a fraction of what they would have to pay for an implementation of SAP or BAAN. This increased the potential size of the market. SAP, is the largest ERP vendor in India, with around 75 customers. Other products include BAAN and JD Edwards. Marshall, a product designed by an Indian company called Ramco is also popular among the smaller companies.

The implementation process of ERP in many Indian organizations has been fraught with problems. These relate to time and money overruns and inadequate planning (Connor 1999). While in some cases, organizations have gained considerable benefits from enterprise systems, in many other cases the results have been, endless implementation cycles, futile re-engineering efforts not accepted by line managers, and rejection of the software as just another technological innovation and not very useful for the business. Organizations have been particularly frustrated with the time and effort involved in the customization of the package (Natarajan 1998).

This paper describes research findings from a study conducted to examine the ERP adoption experiences of Indian organizations. It proposes a framework for analyzing the characteristics of the ERP implementation process and highlights areas of opportunity and risk for ERP adoption in Indian organizations.

RESEARCH PROBLEM

The study of ERP implementation experiences in Indian companies is an interesting case of new technology adoption because many Indian companies go from very rudimentary IT based systems to sophisticated ERP systems in one quantum jump (Sharma 2001). This can give rise to some crucial issues, which may need to be addressed during ERP implementation, and the subsequent use of the software (Markus et al 1999). The literature on the ERP experience in India has been mostly in the nature of business articles in professional / business publications, which either describe the current state of affairs in the ERP industry or report on implementation strategies of individual companies (Connor 1999, Sadagopan 1999, Dasgupta 2001 and Sharma 2001). There are no studies, which analyze and generalize the characteristics and problems of the ERP implementation experience, on the basis of a systematic empirical study. In this paper we describe some qualitative aspects of the principal issues associated with the ERP implementation process in Indian companies. The findings are based on an exploratory study conducted in 25 companies from 10 industries, which have implemented ERP software.

LITERATURE SURVEY

The existing literature on ERP adoption is divided into two tracks. The first track has developed some descriptions of the ERP adoption process. A number of these studies suggest that the ERP implementation process consists of distinct stages. The first stage comprises review and selection of the right package, selection of consultants and clarifying the business related factors that make ERP a necessity. This has been referred to as the Chartering phase (Markus et al 1999) and Design phase (Ross et al 1999). The second stage is the implementation stage and consists of project management, software customization and process re-engineering. This is the Project phase (Markus et al 1999) or Implementation phase (Ross et al 1999). During the third phase, managers familiarize themselves with the software. System bugs are reported and fixed and the operational effects on the business are felt. This is referred to as the Shakeout (Markus et al 1999 et al) or the Stabilization Phase (Ross et al 2000). Finally an organization enters the Upward and Onward phase (Markus et al 1999) or Transform-

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mation phase (Ross et al 2000) in which strategic business benefits occur, additional skills are built and upgrades are planned for.

The second track analyses the ERP implementation process in terms of changes that take place in the organization. One such study conducted by Scott et al (2000) suggests that ERP adoption results in four distinct change components. Technical change processes imply changes in the IS architecture (hardware and software). Business process changes result in process re-engineering. The Organizational learning process incorporates increased competence with new technology and acceptance of technology in business processes. The ERP Use process helps managers learn from the successes and failures of working with the ERP software and carry out related incremental technical and process improvements.

RESEARCH DESIGN

Research Questions

The literature review suggests that the stages in the ERP implementation process consist of activities either to resolve technical issues or to manage changes with regard to business processes and skill development. Building on these theoretical concepts, this study has attempted to analyze and describe the characteristics and underlying themes of different stages in the ERP implementation process in Indian companies.

The following research questions have been explored in this paper:

1. What were the factors that characterized the planning process building up to the ERP implementation exercise?
2. How was the ERP implementation process executed? What were the problems faced during implementation?
3. What were the issues in the organizational acceptance of the ERP system?
4. What were the operational and strategic impacts of the ERP system?

Research Methodology

The research in the problem domain, in Indian organizations is still at a very preliminary stage. Therefore the exploratory survey research method was used for this study. This method is recommended and widely used (Kerlinger 1986, Guba et al 1994) in generating rich process descriptions of emerging fields of study.

Questionnaire

The questionnaire contained questions about the following aspects.

1. The general nature and characteristics of the company's business such as the industry, the number of facilities and products, the success factors, and the kind of information processing tools required by the business.
2. Why the use of ERP was considered, what goals it was expected to achieve, and what role it was expected to play in the organization.
3. Information regarding the implementation process, such as the sequence in which the different modules were implemented, the allocation of manpower for the purpose, and the role of the consultants involved.
4. Changes instituted as a result of implementation of the software such as changes in the organization structure, culture and business processes.
5. The impact of the ERP software on the operations of the organization.

Sample Set

The study was conducted in 25 companies from 10 different industries (both manufacturing and service), which had implemented ERP software. The research sought the perspectives of two people in each organization. One of them was the manager who had headed the implementation. The other one was an executive whose function or

division was impacted consequent to the implementation of the ERP software. The organizations can be broadly classified along the following categories.

Table 1: Industry classification of organizations surveyed

Industry	Standard Industry Classification Code (North American)
Cellular Service Provider	4812
Power Generation and Distribution	4911
Paints	2851
Steel	3212
Telecommunications Equipment	3669
Electronic Equipment	3641
Metal Mining and Processing	1081
Textile	2241
Petroleum Refining and Distribution	1629
Oxygen	2813

The data was analyzed across and within industries. The broad themes that emerged have been described in the next section.

A FRAMEWORK FOR ANALYZING THE ERP IMPLEMENTATION PROCESS

An analysis of the results from the survey showed that the ERP implementation process in Indian companies can broadly be modeled as a three stage process. These stages have been described below.

Planning Stage

The decision to adopt ERP software was usually a part of the strategic information systems plan. The planning process, as revealed by the study, was carried out within the framework of four factors.

(a) Business Case for ERP

For 89% the companies surveyed, the decision to implement ERP was part of a larger attempt towards reducing costs and increasing market share and profitability. They expected that ERP would improve their critical processes and help achieve efficiency in the critical success factors. For example, two companies were low cost producers in their industries and wanted to use ERP for better information management regarding their inventory, which would help reduce their inventory levels.

The rest of the companies implemented ERP for two reasons. Those companies, which had plenty of slack resources, adopted ERP as a result of similar actions on part of their competitors. They were not very clear as to the deliverables they wanted from the use of the software. The second reason was that some organizations were looking for Y2K compatibility. They were primarily concerned with the technical design of the software, its utility as an integrated transaction processing system and its value in streamlining the data storage and retrieval process in the organization.

40% the organizations surveyed expected to re-engineer their processes completely using the "best practices" feature of the software, and 60% planned to incorporate ERP into their existing processes without substantially changing them.

(b) Business Characteristics

The nature of the implementation plan was determined by the characteristics of the business and industry. 65 % of the organizations

had a turnover greater than 5000 Indian Rupees (INR) million. More than 90% of the companies were innovative and introduced 4 or more new products in a year. They were among the first in their industries to introduce the ERP software.

Most of the organizations had multiple products and services, and operated out of many different facilities. They first implemented the sales and distribution and materials management modules for addressing the information processing requirements of the inventory management and distribution functions.

One of the prominent characteristics of the organizations was that the majority of them (88%) needed extensive information interchange among processes. This implied process integration across different functions. Therefore the internally focused modules such as materials management and production planning modules were among the first to be implemented in these companies. This finding was in support of the oft-quoted reason for ERP implementation, namely, the existence of islands of information within the organization (Dav-enport 1998, Wagle 1998 and Markus et al 1999.). For some companies, the information content of the product was high. These companies implemented predominantly the financial accounting and control modules.

Another characteristic of most of the organizations (88%) was that communication processes were formal and used a mix of paper and electronic modes. For the remaining organizations where word of mouth communication was common, ERP was one of the means to formalize the communication processes.

(c) Manpower Planning

For all the companies, the ERP project was much larger than any previous IS project in terms of the scale of resource commitment, range of operations affected, and the number of people involved in development and technical support. Therefore the risk of failure was perceived to be high. The major manpower planning aspects included recruitment of external consultants, formation of the project team, and allocation of executives from the functional areas to the project team. The best functional executives were allocated to the ERP project team. A quarter of the organizations felt that this left the other functional areas inadequately staffed.

(d) Impact on IT Strategy

88 % of the respondents said that they had a separate MIS department in their organizations, prior to the start of the implementation of the ERP software. In 82% of these companies, the MIS department performed routine maintenance jobs. In the remaining organizations, IS professionals developed software for different functions and departments. Hence these companies had significant project management capabilities which they could use during the ERP implementation process. The others companies acquired these skills through professional assistance from external consultants during the ERP implementation process.

For 80% of the companies, the IS function was not considered to be important in that the head of the MIS department was not a member of the top management team and did not participate in strategic planning, prior to the implementation of the ERP software. These companies radically changed the status of the IS function as part of the manpower planning operations. Some of them instituted new CIO positions. These positions were powerful and visible, and took charge of the implementation process. IS professionals, trained in both technology and business were recruited. In some organizations the existing IS head was given greater powers and made responsible for heading the implementation process. In a few companies, a senior functional executive was delegated to manage the implementation process, to whom the existing IS head reported.

In most of the companies (70%) only the basic accounting processes were automated prior to the introduction of ERP. In some of them (30%), inventory-recording functions were also computerized. 12% of the companies had some decision support applications for forecasting, prior to ERP.

Most companies (79%) had different PC based FoxBase or dBase applications for different departments, rather than client server systems. Consequently there were significant changes in the IT strategy and architecture as a result of ERP implementation. These changes involved migration of data from legacy systems into an integrated platform, integration of application programs into the enterprise system, and connection of separate servers and terminals into a single networked configuration. This is an interesting aspect of ERP adoption in developing countries in that organizations often have to migrate from elementary PC based applications to sophisticated client-server architectures at one go.

Implementation Stage

The second stage of the ERP process was the **Implementation Stage**. Two major aspects were found to describe this stage.

(a) Change Management

ERP resulted in significant changes at various levels in all the organizations. Task definitions changed and new skills were required, as different tasks were combined together, for many processes. Hence many employees (47%) felt that their responsibilities had increased. Reorganization of tasks resulted in changes in the reporting structure for 65% of the companies. In 53% of the organizations there was greater transparency as a result of changes in financial reporting practices.

Most companies experienced that technical changes were relatively easier to institute because they required hard skills that could be developed or purchased. Employees found it more difficult to accept the new reporting structures, the re-organized processes and the new ways of working. These transformations were even more difficult to accept quickly because of the magnitude of change involved. Almost every important function was altered in some way. Senior managers were apprehensive that they were not able to communicate clearly enough to the rest of the organization, the nature and rationale behind the changes that were necessitated by the new software. This increased the potential probability of the changes being rejected. Hence the primary risk of failure of the ERP system stemmed from human change acceptance issues, and not technical problems.

(b) Technical Skills

For most of the organizations (83%) the ERP system was significantly different from their existing systems, and required new and advanced technical skills. Only 25% felt that their present crop of IT people were qualified to handle the sophisticated technology. Hence the implementation process was at all times a joint exercise between external consultants and company employees in 90% of the organizations. These consultants also trained the IS professionals, who carried out the post implementation maintenance of the system. This was a double-edged sword because ERP skills were marketable and many organizations were worried about increased dependence on employees whose potential rate of attrition could be very high. Such instances have been reported in several studies conducted by SAP. Moreover, those IS professionals who were not directly involved in the ERP project or had not trained on the software, were often cynical of the possible benefits from the projects. In 40% of the cases they refused to co-operate. In 20% of the organizations, they actively tried to derail the implementation process. For a small fraction of the organizations (10%), third party vendors maintained the ERP system.

Post Implementation Review

The final stage in the in the ERP implementation process was the **Post Implementation Review Stage**. This stage consisted of activities of the following broad themes.

(a) Process Changes

For 50% of the organizations, there had been significant changes in business processes. The remaining companies customized the ERP

software to the requirements of their existing processes. In 30% of the cases, there was greater understanding of task requirements because of multi-tasking and the combination of different stages of tasks into single steps. There were enhancements in the overall technical capacities of employees and IS professionals in 35% of the companies.

(b) Improved Performance Across Operational Parameters

Many organizations experienced tangible, operational benefits as a result of ERP implementation. Customer service improved in 53% of the companies, cost control in 47%, and inventory levels decreased in 35% of the companies. Real time processing of financial and other information was facilitated in 35% of the companies. Most of the organizations felt that it was too early to decide whether there was any effect on financial performance as a result of ERP; however it was expected that the operational improvements would lead to financial returns also.

The most significant change in many organizations (35%) was that they had moved from being individual function driven to process driven. This was because consequent to task reorganization and multi-skilling, employees could appreciate the entire process, rather than just a small part. In supporting findings, 41% of the respondents felt that there was improved integration between different processes, and 35% felt that there was improved job design as a result of ERP. Most of the companies also felt that ERP resulted in fewer overlapping activities and more clearly understood roles.

About 40% of the companies did not perceive any operational benefits after the ERP implementation. The only perceived changes were increased structure and method in their processes. They felt that the software was difficult to navigate, there were too many complex screens and it took a long time to complete the tasks.

(c) Better Availability of Data

Almost all the organizations said that there was better access to information at the point of origin, and better flow of information across different departments after the ERP software was implemented. Employees felt empowered because they could conveniently access information that was required for decision-making. For 35% of the companies, this led to better decision-making and greater accountability.

(d) Learning From Subsequent Stages

ERP has traditionally been used to integrate internal processes of companies and create a systematic structure for storing and retrieving information seamlessly across functions. It was interesting to note that most of the companies implemented only those modules, which they considered important for their operations. 90% of the companies carried out phased implementation, instead of a big bang implementation. This was because of two reasons. Firstly, most organizations did not want to commit the vast resources required for a big bang implementation, especially because these were significantly greater than their annual IT budgets. Secondly, ERP software required advanced technology and was very different from the existing systems. Organizations preferred to change gradually and minimize the risks of failure. Hence they went in for phased implementation. It is interesting to note that those companies which were relatively advanced users of IT, first implemented ERP in their most successful and high profile divisions. These formed about 35% of the sample. Other organizations implemented ERP in their least busy and least important division to begin with. Organizations which adopted the phased approach, perceived themselves to be well prepared for subsequent rounds of implementation both in terms of technical preparedness and ability to articulate and communicate the rationale behind the change process.

The results of the study have been summarized in Table 2

CONTRIBUTIONS AND SCOPE FOR FURTHER RESEARCH

This paper is one of the first attempts at empirical research, in the domain of ERP implementation in India. The major theoretical

Table 2: Framework summary

Process Stage	Principal aspects of the Stage	Description of Principal Aspects	Implications for Managers
Planning	Business Imperatives for ERP	Planned as part of a larger attempt towards reducing costs and increasing market share and profitability	Clear idea of the deliverables from the process is desired
		Expected change of processes to suite the ERP software	Detailed plan for process re-engineering is required
		Response to competitor's actions	Awareness of the latest ERP technologies and application to the business
		Technical upgradation of IS architecture	
	Business characteristics	Innovators and pioneers in the industry	Study of problems with existing processes and the nature of information flow is required.
		Multiple products and facilities all over India	
		Extensive information interchange along processes	Rationalization of information hand-offs is required.
		Islands of computerization and information availability	
	Manpower Planning	Working with external consultants	Review and selection of consultants based on experience and estimated cost is necessary.
		Formation of ERP project teams	Planning for the temporary transfer of employees from functional areas to the project team is essential
	Impact on IT Strategy	Acquisition of radically new technologies	Planning for increases in IT budget
		Development of advanced technical and project management skills	Training and technical skill acquisition plan is required
		Change in the status of the IS function	Restructuring and new recruitment for the IS function is necessary
Implementation	Change Management	Change in processes	Management of Change:
		Change in reporting structure	Communication of the rationale behind the ERP implementation process and the accompanying changes
		Change in task job definition	
		Change in financial reporting practices	
	Technical skills	Training of existing IT personnel and recruitment of new IT personnel	Management of expectations of IS professionals not involved in the project: Motivation problems.
			Management of expectations of IS professionals involved in the project: Attrition problems of trained IS professionals
Process Stage	Principal aspects of the Stage	Description of Principal Aspects	Implications for Managers

contribution of the paper is that it presents a general conceptual framework through which issues related to ERP implementation in Indian organizations can be analyzed and the relevant aspects addressed, by individual companies. The generality of the framework has been further enhanced because of the number of industries covered in the study. The practical implications of the framework for managers have also been presented and relevant strategies for controlling some of the implementation aspects have been described.

The findings of this study are based on exploratory research on a limited data set. Exploratory Survey was considered appropriate because there has been virtually no research in this problem domain. This study generates scope for further research in that these findings could be validated in a second confirmatory study on a larger data set. It would also be interesting to study the differences in the model, with similar models developed by Markus et al (1999) and Ross et al (2000).

CONCLUSIONS

Over the last few years, many organizations in India have implemented ERP solutions and have consequently benefited from improved processes and better information availability. For many others (Natarajan 1999 and Rajshekhar et al 2000), the adoption of ERP has

resulted in a very painful transition and adaptation period, while the benefits have not been immediate or tangible. In fact, in some cases the benefits have been perceived to be much less when compared to the massive costs. The model serves as a useful starting point from where the ERP experience of Indian companies can be analyzed. It also presents some practical implications for managers, for managing and controlling relevant aspects of the implementation process.

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