



IMPACT OF ERP SYSTEMS ON SMALL AND MID SIZED PUBLIC SECTOR ENTERPRISES

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ABSTRACT

ERP Systems are the most integrated information systems that cut across various organizations as well as various functional areas. It has been observed that ERP systems prove to be a failure either in the design or its implementation. A number of reasons contribute in the success or failure of an ERP systems. Success or failure of ERP system can be estimated on the basis of impact of ERP on that organization. In this paper an attempt has been made to study the impact of ERP systems in mid-sized Indian public sector organizations. For this study, two public sector companies namely PUNCOM and PTL located in northern India have been selected. Based on the model used to study ERP impact and thus the findings, various recommendations have been put forward to suggest a strategy so as to mitigate and manage such successful implementation.

Keywords: *Enterprise Resource Planning (ERP), ERP impact, ERP Design and Implementation, Information systems auditors.*

1. INTRODUCTION:

Enterprise Resource Planning software systems (ERP) encompass a wide range of software products supporting day-to-day business operations and decision-making. ERP serves many industries and numerous functional areas in an integrated fashion, attempting to automate operations from supply chain management, inventory control, manufacturing scheduling and production, sales support, customer relationship management, financial and cost accounting, human resources and almost any other data oriented management process. ERP systems are designed to enhance organization's competitiveness by upgrading an organization's ability to generate timely and accurate information throughout the enterprise and its supply chain. A successful ERP system implementation can shorten production cycles, increases accuracy of demand for materials management & sourcing and leads to inventory reduction because of material management, etc. Moreover it can be used as a primary tool for re-engineering. However various studies have revealed that not all ERP implementations are successful. According to Gray A. Langenwalter (2000), ERP implementation failure rate is from 40% to 60%, yet companies try to implement these systems because they are absolutely essential to responsive planning and communication. The competitive pressure unleashed by the process of globalization is

driving implementation of ERP projects in increasingly large numbers, so a methodological framework for dealing with complex problem of evaluating ERP projects is required.

It has been found that, unique risks in ERP implementation arises due to tightly linked interdependencies of business processes, relational databases, and process reengineering (Sally Wright, Arnold M. Wright, 2002). Similarly, business risks drive from the models, artifacts, and processes that are chosen and adopted as a part of implementation and are generated from the firm's portfolio of MAP's with respect to their internal consistency and their external match with business partners. Organizational risks derive from the environment – including personnel and organizational structure – in which the system is chosen and implemented (Daniel E. O'Leary, 2000). According to Umble & Umble (2002), three main factors that can be held responsible for failure of ERP system are: poor planning or poor management; change in business goals during project; and lack of business management support. In another study, it has been found that companies spent large money in developing ERP systems that are not utilized. It is quite common for ERP project to finish late, cost more than predicted, unreliable and difficult to maintain. Moreover BPR also had a high failure rate with consultants estimating that as many as 70% of the BPR projects fails (Hammer and Champy, 1993).



Hammer (1990) advocates that the power of modern technology should be used to radically design business processes to achieve dramatic improvements in their performance. From a software perspective ERP systems is complete. But from the business perspective it is found that software and business processes needs to be aligned, which involves a mixture of business process design and software configurations (Hamer, 1990). So a purely technical approach to ERP system design is insufficient.

According to David Allen, Thomas Kern (2002), a careful use of communication and change management procedures is required to

handle the often business process reengineering impact of ERP systems which can alleviate some of the problems, but a more fundamental issue of concern is the cost feasibility of system integration, training and user licenses, system utilization, etc. needs to be checked. A design interface with a process plan is an essential part of the system integration process in ERP. By interfacing with a process plan module, a design interface module helps the sequence of individual operations needed for the step-by-step production of a finished product from raw materials (Hwa Gyoo Park). Similarly the contributions made by many other authors have been listed in the Table 1 as given below:

Table 1: Literature Review for ERP Implementation and Impact

Study	Authors
Justify the ERP System based on reliable figures and well thought through assumptions.	Pernille Kraemmerand, Charles Moller, Harry Boer
Use right mix of business analyst, technical experts and users from within the implementation company and consultants from external companies.	Anne Parr & Graeme Shanks
ERP systems helps in reducing inventory level by 15-20% in overall channel	Elsiabeth J. Umble & Michael Umble
Financial accounting and treasury management module helps in improving cash management	Fiona Fui-Hoon Nah, Kathryn M. Zuckweller, Janet Lee-Shang Lau
Identify strategies to re-skill the (IT) workforce and acquire external expertise.	Pernille Kraemmerand, Charles Moller, Harry Boer
Integrated enterprise level applications reduces various cycle times in different processes	Pernille Kraemmerand, Charles Moller, Harry Boer
Top management's advocacy, provision of adequate resources and commitment to project.	Anne Parr & Graeme Shanks
New ERP applications are Y2K compliant	Elsiabeth J. Umble & Michael Umble
Extended ERP with CRM and SCM packages strengthens the overall supply chain of the organization	Fiona Fui-Hoon Nah, Kathryn M. Zuckweller, Janet Lee-Shang Lau
Top management commitment to restructuring and following an enterprise-wide design which supports data integration.	Mary Sumner
ERP reduces organizational business risks and enhances regulatory compliances	Pernille Kraemmerand, Charles Moller, Harry Boer
Organizations commitment for change and determination in face of inevitable problems with implementation.	Anne Parr & Graeme Shanks
ERP systems increases stakeholders confidence in the organization	Elsiabeth J. Umble & Michael Umble
Implementation requires major commitment from an organization's	Theodore Grossman and



employee.	James Walsh
It delivers clear communication of strategic goals.	Elsiabeth J. Umble & Michael Umble
Communication is complete, and targeted. Communications is important at all levels and among stakeholders.	Fiona Fui-Hoon Nah, Kathryn M. Zuckweller, Janet Lee-Shang Lau
It helps in effective communications.	Mary Sumner
Communication is essential for creating approval and widespread understanding and acceptance of ERP.	Pernille Kraemmerand, Charles Moller, Harry Boer
View ERP as a enterprise-wide venture.	Elsiabeth J. Umble & Michael Umble
The ERP implementation is viewed as an ongoing process.	
The steering committee determines the scope and objectives of the project in advance and then adheres to it.	Anne Parr & Graeme Shanks
ERP package selection is a very important step in whole implementation process	Elsiabeth J. Umble & Michael Umble
Objective is to find GAP between the definition of processes in ERP system and their definition in organization.	Niv Ahituv, Seev Neumann and Moshe Zviran
Different management competences, in particular personal, business and technological competences, dominate different stages of ERP journey.	Pernille Kraemmerand, Charles Moller, Harry Boer
Minimal customization and uncomplicated option selection	Anne Parr & Graeme Shanks
Configuration of overall ERP architecture, appropriate modeling methods/techniques, vigorous and sophisticated testing is important.	Fiona Fui-Hoon Nah, Kathryn M. Zuckweller, Janet Lee-Shang Lau
ERP system centralizes the overall auditing process in an organization	Anne Parr & Graeme Shanks
Project champion is more important in ERP implementation.	Fiona Fui-Hoon Nah, Kathryn M. Zuckweller, Janet Lee-Shang Lau
It facilitates in improved service to customers and suppliers.	Marc N. Haines, Dale L. Goodhue.
ERP makes MIS more accurate and accessible	Mary Sumner
Acquiring vendor support for capacity planning and upgrading.	
ERP configuration requires large amount of BPR should occur iteratively to take advantage of the best practices.	Fiona Fui-Hoon Nah, Kathryn M. Zuckweller, Janet Lee-Shang Lau
Re-engineer the business processes to fit to the standard model and the pre-configured processes and transactions embedded in the software; avoid modifications of the software code to fit to the organizations current processes.	Pernille Kraemmerand, Charles Moller, Harry Boer
ERP is just as much an organizational and business issue as it is about technology. Successful implementation requires that three aspects are balanced continuously.	
Set realistic milestones and end dates	Anne Parr & Graeme Shanks



Milestones and targets need to be actively monitored to track the progress of an ERP project.	Fiona Fui-Hoon Nah, Kathryn M. Zuckweller, Janet Lee-Shang Lau
It reduces, information processing cost, bonding cost, residual cost, communication and documentation cost	Pernille Kraemmerand, Charles Moller, Harry Boer
Package installation must be scheduled as it takes time and costs more than originally planned.	Theodore Grossman And James Walsh
A loose budget policy in terms of time and cost restrictions, in the innovation phase (visioning, software selection, test ad pilot) contributes to program success.	Pieter M.A. Ribbers, Klauss-Aclemens Schoo.
It requires Extensive education and training is provided.	Elsiabeth J. Umble & Michael Umble
The ERP teaching methodology focuses on teaching of three topics: traditional management of operations, integrated and dynamic approach to operations, use of advanced information systems to support management operations.	Avraham Shtub
End user receiving training in four knowledge levels (command based, tool procedural, business procedural, tool conceptual training) are expected to have more accurate mental models over time.	Tony Coulson, Conrad Shayo, Lorne Olfman, C.E. Tapie Rohm.
To realize the benefits of ERP considerably training is required on new system, how to use it, and how will it change the current way of working in terms of new activities and new collaborative relationships.	Pernille Kraemmerand, Charles Moller, Harry Boer
Implement fewer modules and less functionality implemented, smaller user groups and fewer/single sites.	Anne Parr & Graeme Shanks
It allows new services to customers and suppliers	Elsiabeth J. Umble & Michael Umble
It enhances support to organizational processes	Pieter M.A. Ribbers, Klauss-Clemens Schoo.
Need for change is very important as the stronger the need for change, more likely top management and stakeholder will support ERP implementation.	Pernille Kraemmerand, Charles Moller, Harry Boer
ERP implementation will change job descriptions and performance measures. Employees must be given clear job descriptions and performance targets..	
ERP imposes its own login on the organization and becomes a powerful actor in the organization. If the actor is not managed tightly, the functions of the ERP system will tends to drift.	

Understanding of such factors helps in planning and conducting assurance engagements of the reliability of these complex computer systems. But there are certain gaps in existing studies regarding impact of ERP systems on organizations that too in context with small and

mid sized public sector enterprises. With these objectives in mind and based on the above literature survey and discussions held with academicians & users of ERP system, the following factors have been identified (Table 2) to understand the impact of ERP systems.



Table 2: Sub factors for ERP Impact

<p>1. Tangible Benefits after ERP Implementation</p> <p>Inventory Reduction Personal reduction Productivity improvement Order management improvement Technology cost reduction Procurement cost reduction Cash management improvement Revenue/profit improvement Transportation/ logistics cost reduction Maintenance reduction On time delivery improvement</p> <p>2. Intangible benefits after ERP implementation</p> <p>New/improved business processes Customer responsiveness Cost reduction Integration Standardization Flexibility Globalization Year 2000 Business performance Supply/ demand chain Information/visibility Economic Performance of firm (Internal coordination cost) Monitoring cost Bonding cost Residual cost Information processing cost Communication cost Documentation cost Opportunity cost due to poor information</p> <p>3. Business Performance factor</p> <p>Reduced organizations business risks Enhanced organizations regulatory compliance Makes MIS more accurate and accessible. Facilitate improved services to customer and suppliers Allows new services to customer and suppliers Enhanced primary users knowledge and skills Increased institutional accountability Increased shareholders confidence in organization Enhanced support to organizational activities Enhanced organization business performance Decreased work load in various departments Decreased workload in central department ERP is less costly to maintain and operate as compared to legacy systems ERP is less costly to enhance/upgrade as compared to legacy system ERP is less costly to integrate as compared to legacy system ERP made it easier to take advantage of new technology Nature of work in various departments has changed</p>



Objective Keeping in view the importance and gaps in research, a study with an objective to find the impact ERP system on selected organizations and thus on small & mid-sized public sector organizations in India was undertaken.

Scope The study has been conducted in two mid-sized manufacturing public sector organizations PUNCOM (Telecom system) and PTL (Tractors) located in northern India. PUNCOM specialize in R&D as well as manufacturing in telecommunication systems and various related equipments. It has developed its enterprise-wide product to streamline the whole system. On the other hand PTL is large tractor manufacturing unit and is controlling its own several subsidiary units. One of its subsidiaries SWRAJ is developing mini trucks. PTL is using its self designed enterprise-wide product, but is planning to implement SAP.

Research Methodology

1. Secondary data for research was collected from related books, publication, annual reports, and records of organization under study.

2. Primary data has been collected through questionnaire-cum-interview technique. For this purpose questionnaire was created on already established models and survey of literature. Questionnaire was first pre-tested on 20 managers from the actual sample to be interviewed for checking its reliability and content validity. Cronbach’s alpha test was applied, where the value of coefficient was 0.8. Thus pre-tested & modified questionnaire was administered to all the sampled respondents. To understand the impact, all the managers in the EDP departments along with an appropriate sample of the managers at the three levels of the management of each of the selected organizations were selected. The sample of the randomly selected managers was proportionate and statistically sound that represents the universe of managers of the selected organizations. 115

experienced respondents from both the companies who specialize in their related production skills and use of ERP system had participated in the study.

3. Data was collected on 5 point Likert scale depending on the relative importance of a factor. Further average score are calculated for all 115 respondents of two organizations. Further in order to check difference in opinion across all three management levels, independent level t-test and one way ANOVA is applied. For this purpose Null Hypothesis was developed as given below:

H0: $\mu_1 = \mu_2$ (There is no difference in opinion across the two organizations)

H1: $\mu_1 \neq \mu_2$ (There is difference of opinion across the two organizations)

4. Further following norms were considered for the choice of respondents in each participating organizations.

- a. 30% of the population where size > 100
- b. 25% of the population where size < 100

Similarly norms were followed for sample distribution (Level wise) of each of the participating organizations:

- a. Level I (Strategic Planning)
50% of the population.
- b. Level II (Executive Control)
50% of the population.
- c. Level III (Operational Control)
25% of the population

These norms were decided after a detailed discussion with academicians, researchers and industry experts. It was found that by increasing sample size, there was a marginal change in results and effort to collect data would have increased considerably. Following tables and graphs explains the sampling frame.

Table3: Sample Distribution (Company wise)

SNo.	Company	Population	Sample	Response	%age
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1	Punjab Communication Ltd. (PCL)	213	64	60	94%
2	Punjab Tractors Limited (PTL)	206	62	55	89%

Table4: Sample Distribution (Level wise)

Level	Company							
	Punjab Communication Ltd				Punjab Tractors Ltd.			
	Universe	Sample	Response	%age	Universe	Sample	Response	%age
I	13	07	5	71%	8	4	3	75%
II	45	22	20	91%	35	18	16	89%
III	155	39	35	90%	163	41	36	88%

Analysis and Discussions

To study the ERP impact on both the selected organizations, 46 variables were selected from literature review and discussions with ERP practitioners, academicians and researchers. These variables are further classified in three categories:

- Tangible benefits
- Non-tangible benefits
- Impact on business performance.

Tangible benefits of ERP system

Table below gives the average score of tangible benefits among all three management levels of both the selected organizations.

Table 5: Average score for tangible benefits in ERP Implementation (N=115; Min =1 and Max=5)

Factors	Management Levels											
	PTL				PCL				Both PCL and PTL			
	I	II	III	Total	I	II	III	Total	I	II	III	Total
Inventory Reduction *	4.00	4.10	3.49	3.73	4.67	3.56	3.69	3.71	4.25	3.86	3.59	3.72
Personal reduction	3.00	2.80	2.83	2.83	3.33	2.81	2.83	2.85	3.13	2.81	2.83	2.84
Productivity improvement	3.80	3.95	3.49	3.67	4.33	3.63	3.61	3.65	4.00	3.81	3.55	3.66
Order management improvement	4.00	3.55	3.40	3.50	3.00	3.44	3.47	3.44	3.63	3.50	3.44	3.47
Technology cost reduction	3.80	3.15	3.11	3.18	2.33	3.06	3.25	3.15	3.25	3.11	3.18	3.17
Procurement cost reduction	3.00	2.90	2.77	2.83	2.67	2.94	2.89	2.89	2.87	2.92	2.83	2.86
Cash management improvement	4.00	4.00	3.69	3.82	3.33	4.06	3.94	3.95	3.75	4.03	3.82	3.88
Revenue/profit improvement	3.60	3.60	3.09	3.30	2.67	3.56	3.36	3.38	3.25	3.58	3.23	3.34
Transportation/ logistics cost reduction	3.60	3.45	3.03	3.22	3.00	3.25	3.31	3.27	3.38	3.36	3.17	3.24
Maintenance reduction	4.00	3.35	3.46	3.47	3.33	3.38	3.47	3.44	3.75	3.36	3.46	3.45
On time delivery improvement	3.80	3.70	3.26	3.45	4.00	3.50	3.39	3.45	3.87	3.61	3.32	3.45



Above table reveals that overall impact of ERP implementation is not very high on both the selected organizations to achieve tangible benefits (as Avg.<4). At the same time, strategic level managers of both the organizations are of the opinion that implementing ERP has high impact in achieving inventory reduction and productivity improvement (as Avg.>4). Similarly, the strategic level managers of PTL are also of the opinion that, ERP implementation has high impact on improving order management system; cash management; and maintenance reduction. Whereas strategic level managers of PCL are also of the opinion that ERP has high impact on improving on-time delivery system. However executive level managers of both organizations also think that ERP impact is high in achieving cash management. In continuation to this, both PCL and PTL are of opinion that ERP has moderate impact (Avg.>3) to achieve inventory reduction; productivity improvement; order

management; technology cost reduction; cash management; revenue/profit management; transportation/logistics cost reduction; maintenance reduction and on time delivery improvement. Where as ERP impact is low (as Avg.<3) to achieve personal reduction and procurement cost reduction among both the organizations. From above table, it is also clear that strategic level managers of PTL are quite optimistic about impact of ERP implementation as average score for all the tangible benefit variables is greater than 3. On the other hand strategic level managers of PCL are of the view that ERP has low impact over technology cost reduction; procurement cost reduction and revenue/profit improvement. Further both T-test and ANOVA test results proves similarity in opinion across various management levels as significance value is greater than 0.05 for almost all the factors (see Table 6).

Table 6: Difference in opinion across management levels of PCL & PTL for impact of ERP system to achieve tangible benefits (N=115).

	T-Test at 99% confidence level (Sig. < 0.05)			ANOVA at 95% confidence level
	Top	Middle	Lower	
Inventory Reduction		√ (0.043)		
Personal reduction				
Productivity improvement				
Order management improvement				
Technology cost reduction	√ (0.038)			
Procurement cost reduction				
Cash management improvement				
Revenue/profit improvement				
Transportation/ logistics cost reduction				
Maintenance reduction				
On time delivery improvement				

ERP impact to achieve non-tangible benefits

Table below gives the average score for all non-tangible achieved by ERP implementation as tested in PCL and PTL

Table 7: Average score for non-tangible benefits after ERP Implementation (N=115; Min =1 and Max=5)

Factors	Management Levels											
	PTL				PCL				Both PCL and PTL			
	I	II	III	Total	I	II	II	Total	I	II	III	Total
New/improved business processes	4.40	4.05	4.00	4.05	4.67	3.81	4.03	4.00	4.50	3.94	4.01	4.03
Customer responsiveness	3.80	3.85	3.46	3.62	3.33	3.63	3.53	3.55	3.63	3.75	3.49	3.58
Cost reduction	4.00	3.65	3.37	3.52	3.00	3.69	3.42	3.47	3.63	3.67	3.39	3.50
Integration	4.40	3.95	3.77	3.88	3.67	3.81	3.89	3.85	4.13	3.89	3.83	3.87



Standardization	4.00	3.90	3.80	3.85	3.67	4.00	3.78	3.84	3.88	3.94	3.79	3.84
Flexibility	4.00	3.85	3.71	3.78	3.67	3.81	3.83	3.82	3.88	3.83	3.77	3.80
Globalization	3.80	3.70	3.37	3.52	3.33	3.50	3.58	3.55	3.63	3.61	3.48	3.53
Year 2000	3.00	3.20	2.89	3.00	3.33	3.00	3.14	3.11	3.13	3.11	3.01	3.05
Business performance	4.00	4.05	3.91	3.97	4.33	4.06	3.94	4.00	4.13	4.06	3.93	3.98
Supply/ demand chain	3.80	3.60	2.83	3.17	3.00	3.25	3.25	3.24	3.50	3.44	3.04	3.20
Information/visibility	4.60	4.55	4.06	4.27	4.67	4.25	4.36	4.35	4.63	4.42	4.21	4.30
Monitoring cost	3.20	2.80	2.63	2.73	2.33	2.75	2.83	2.78	2.88	2.78	2.73	2.76
Bonding cost	3.00	2.85	2.43	2.62	2.00	2.88	2.78	2.76	2.63	2.86	2.61	2.69
Residual cost	2.80	2.80	2.37	2.55	2.67	2.69	2.72	2.71	2.75	2.75	2.55	2.63
Information processing cost	3.60	3.85	3.51	3.63	4.00	3.81	3.58	3.67	3.75	3.83	3.55	3.65
Communication cost	4.00	4.25	3.80	3.97	4.33	4.06	3.97	4.02	4.13	4.17	3.89	3.99
Documentation cost	4.60	4.50	4.00	4.22	5.00	4.00	4.22	4.20	4.75	4.28	4.11	4.21
Opportunity cost due to poor information	4.40	3.85	3.43	3.65	3.67	3.69	3.72	3.71	4.13	3.78	3.58	3.68

From above table it is clear that both the organizations agree over factors like: new/improved business processes; information visibility and reduction in documentation cost, etc as highly important (as Avg.>4). At the same time strategic level managers of both PCL and PTL are also of the opinion that ERP impact is high on factors like overall integration; improved business performance; reduction in communication cost and decreased opportunity cost due to poor information. However, top level managers of PTL also agrees, that ERP has high impact on cost reduction, standardization and increased flexibility in the system. Whereas top level respondents of PCL had also given high score to

impact of ERP in reducing information processing cost. Further, all management levels agrees that ERP implementation has moderate impact to achieve customer responsiveness; integration; overall cost reduction; standardization; flexibility; globalization; Year 2000 solution; improved supply/demand chain and information processing cost. Whereas ERP impact is low (as Avg.<3) in reducing monitoring cost; bonding cost and residual cost. Further, from the results of T-test and ANOVA test it is clear that there is no difference in opinion for various factors except documentation cost as significance value is greater than 0.05 for all the factors (see Table 8).

Table 8: Difference in opinion across management levels of PCL & PTL for impact of ERP system in non-tangible benefits (N=115).

Factors	T-Test at 99% confidence level (Sig. < 0.05)			ANOVA at 95% confidence level
	Top	Middle	Lower	Total
New/improved business processes				
Customer responsiveness				
Cost reduction				
Integration				
Standardization				
Flexibility				
Globalization				
Year 2000				
Business performance				
Supply/ demand chain				
Information/visibility				
Monitoring cost				
Bonding cost				
Residual cost				
Information processing cost				



Communication cost				√ (0.013)
Documentation cost		√ (0.042)		
Opportunity cost due to poor information				

So, for all other non-tangible benefits except documentation cost, Null hypothesis (H0) is selected against alternate hypothesis (H1).

Business performance impact of ERP system

The table below gives the average score of all three management levels across both PCL and

PTL for impact of ERP implementation to achieve business performance.

Table 9: Average score for business performance impact after ERP Implementation (N=115; Min =1 and Max=5)

Factors	Management Levels											
	PTL				PCL				Both PCL and PTL			
	I	II	III	Total	I	II	III	Total	I	II	III	Total
Has reduced organizations business risks	4.20	3.45	3.20	3.37	3.00	3.38	3.36	3.35	3.75	3.42	3.28	3.36
Enhanced organizations regulatory compliance	4.00	3.75	3.49	3.62	3.67	3.56	3.81	3.73	3.88	3.67	3.65	3.67
Has made MIS more accurate and accessible.	4.40	4.25	4.11	4.18	4.33	3.94	4.33	4.22	4.38	4.11	4.23	4.20
Has facilitated improved services to customer and suppliers	4.20	3.90	4.11	4.05	3.33	3.88	4.14	4.02	3.88	3.89	4.13	4.03
Has allowed new services to customer and suppliers	3.60	3.35	3.54	3.48	3.00	3.25	3.47	3.38	3.38	3.31	3.51	3.43
Has enhanced primary users knowledge and skills	4.60	4.45	4.37	4.42	4.33	4.37	4.50	4.45	4.50	4.42	4.44	4.43
Has increased institutional accountability	4.00	4.05	3.91	3.97	3.67	4.06	3.97	3.98	3.88	4.06	3.94	3.97
Has increased shareholders confidence in organization	4.40	4.40	4.23	4.30	4.33	4.19	4.42	4.35	4.38	4.31	4.32	4.32
Has enhanced support to organizational activities	4.40	3.95	3.63	3.80	3.67	3.56	3.94	3.82	4.13	3.78	3.79	3.81
Has enhanced organization business performance	4.40	4.30	4.00	4.13	4.67	4.06	4.17	4.16	4.50	4.19	4.08	4.15
Has decreased work load in various departments	4.60	4.70	4.46	4.55	4.67	4.56	4.67	4.64	4.63	4.64	4.56	4.59
Has decreased workload in central department	3.60	3.85	3.89	3.85	4.00	3.94	3.97	3.96	3.75	3.89	3.93	3.90
ERP is less costly to maintain and operate as compared to legacy systems	2.80	3.00	3.29	3.15	3.67	3.25	3.03	3.13	3.13	3.11	3.15	3.14
ERP is less costly to enhance/upgrade as compared to legacy system	4.00	3.55	3.20	3.38	3.33	3.38	3.36	3.36	3.75	3.47	3.28	3.37
ERP is less costly to integrate as compared to legacy system	3.40	3.30	3.23	3.27	3.33	3.31	3.33	3.33	3.38	3.31	3.28	3.30



ERP made it easier to take advantage of new technology	3.60	3.55	3.49	3.52	4.00	3.44	3.50	3.51	3.75	3.50	3.49	3.51
Nature of work in various departments has changed	4.20	4.60	4.20	4.33	4.67	4.44	4.28	4.35	4.38	4.53	4.24	4.34

According to above table, overall response of all three management levels is very high (as Avg.>4) for factors like: achieve accuracy in management information system; improved services to customers and suppliers; knowledge enhancement of primary users; increased shareholders confidence in organization; improved business performance; decreased work load in various departments and changed nature of work in various departments. However, strategic level managers of PTL are also of the opinion that ERP implementation has highly reduced business risks; enhanced organizations regulatory compliance; increased institutional accountability and enhanced support to organizational activities. Similarly all management levels agrees that ERP implementation has moderate impact to achieve reduction in organizations business risks;

enhanced regulatory compliances; new services to customers and suppliers; increased institutional accountability; enhanced support to organizational activities; decreased workload in central department; less costly to maintain/operate; enhancing/upgrading as compared to legacy system; and made easier to take advantage of new technology (as Avg.>3). However, strategic level managers of PTL had rated very low for the factor that ERP is less costly to maintain and operate as compared to legacy system (as Avg.<3). Further from T-test and ANOVA test results (see Table 10), it is clear that among all management levels across both PCL and PTL, there is no difference in opinion as significance value of these factors is greater than 0.05. Hence, Null hypothesis is selected for almost all the factors.

Table 10: Difference in opinion across management levels of PCL & PTL for impact of ERP system in business performance (N=115).

Factors	T-Test at 99% confidence level (Sig. < 0.05)			ANOVA at 95% confidence level
	Management Levels			
	I	II	III	
Has reduced organizations business risks				
Enhanced organizations regulatory compliance			√ (0.046)	
Has made MIS more accurate and accessible.				
Has facilitated improved services to customer and suppliers				
Has allowed new services to customer and suppliers				
Has enhanced primary users knowledge and skills				
Has increased institutional accountability				
Has increased shareholders confidence in organization				
Has enhanced support to organizational activities				
Has enhanced organization business performance				
Has decreased work load in various departments				
Has decreased workload in central department				
ERP is less costly to maintain and operate as compared to legacy systems				
ERP is less costly to enhance/upgrade as compared to legacy system				
ERP is less costly to integrate as compared to legacy system				
ERP made it easier to take advantage of new technology				
Nature of work in various departments has changed				



Finally, the analysis of data suggests that some of the key tangible benefits of implementing ERP systems are: inventory management, productivity improvement and cash management. Similarly, key non tangible benefits of implementing ERP are: reduction in different operating and maintenance costs, improved business processes, process standardization and information visibility. Other business performance impact on organization could be: enhanced regulatory compliance, more accurate MIS, increased institutional accountability, and reduced work load in different departments.

Conclusions: Empirical data results have provided general support for our hypotheses. We find that ERP adopters are consistently higher in performance across a wide variety of measures than non-adopters. Overall, this suggests that indeed ERP systems yield substantial benefits to the firms that adopt them, and that the adoption risks do not exceed the expected value, although there is some evidence (from analysis of financial leverage) that suggests that firms do indeed perceive ERP projects to be risky. There also appears to be an optimal level of functional integration in ERP with benefits declining at some level. While our data does not currently allow more detailed analysis of the exact pattern of adoption (due to lack of detailed data on the extent of deployment at the worker level) or the long-term impact on productivity (due to lack of long-term post implementation data at this time), both of these issues are promising areas for future research.

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