

---

## Success of ERP system in Indian industries: A comparative study among selected industries

Ch. Seetha Ram

Dept. of Systems, GITAM Institute of Management, GITAM University, Visakhapatnam-530 045, AP, India

drcsr@yahoo.com

---

### Abstract

Enterprise solutions provide a centralized framework for all data and processes of an organization. It integrates all aspects of a business from planning to inventory control, manufacturing, sales, marketing, finance, customer service and human resources. A significant part of our service portfolio is our customized ERP solutions. The SAP business and MS dynamics NAV services provided by us include: software licensing, data migration, implementation, support, consultancy and training. We deploy resources on integrated teams that work with our clients to undertake complex enterprise transformation efforts. Selection of the three organizations is based on the need to collect detailed data about the ERP implementation process in each organization. In all the three industries, questionnaires were sent to 600 end-users. A total of 202 questionnaires taken for analysis have shown that the first three dominant success factors of TI infotech, BPCL and ITTI are related to the quality dimensions, suggesting that the success of implementing ERP system is largely determined by the quality dimensions. Thus the technological newness was the most important factor in determining the quality of the system.

**Keywords:** ERP success model, DeLone and McLean model, high-tech firms.

---

### Introduction

Organizations today are constantly in search for ways to achieve better business performance and sustain competitive advantages through effective deployment of resources and business processes. To improve business performance, organizations require an efficient planning and control system that synchronizes planning of all processes across the organization. The key to competitiveness lies in a solid information system (IS) infrastructure seamlessly aligned with core business processes developed for the delivery of high quality products and services to customers within the optimal time. These demands have prompted more firms to shift their IS strategies from developing in-house information systems to purchasing application software, such as ERP systems, to generate synergies and enhance operating efficiency (Hong & Kim, 2002). However, scarce work exists on measuring success for an ERP system. Although it is very important to evaluate the success of ERP implementation projects since a lot of financial and human resources are invested (Bradford and Sandy, 2002) reported that 57% of the interviewed companies launched no assessments on the performance of ERP systems owing to lack of empirically effective evaluation models. Information systems (IS) success is one of the most widely used dependent variables in information systems research. Not surprisingly, much attention has been given to how best to measure it (De Lone & McLean, 1992). This research accordingly attempts to propose a success model for ERP systems and to empirically investigate the multidimensional relationships among the success measures. Additionally, three case firms among the success measures are also empirically tested. Enterprise solutions provide a centralized framework for all data and

processes of an organization. It integrates all aspects of a business from planning to inventory control, manufacturing, sales, marketing, finance, customer service and human resources. A significant part of our services portfolio is our customized ERP solutions (De Lone & McLean, 2003). At Icreon, we provide cost effective enterprise solutions that are developed and customized keeping in mind the individual requirements of clients and their areas of operation. Our process experts will evaluate every detail and thoroughly assess each option that they draw for your organization. Our enterprise solutions enable the integration of all business activities of an organization thereby improving operational efficiency. The SAP business one and MS dynamics NAV services provided by us include: software licensing, data migration, implementation, support, consultancy and training. We deploy resources on integrated teams that work with our clients to undertake complex enterprise transformation efforts (Rai *et al.*, 2002).

### Applying the IS success model in the research context

Following the logic framework of the updated De Lone and McLean model for IS success, this study proposes a success model for ERP systems. ERP systems are one type of Integrated IS to cover all necessary business processes, thus system quality, information quality, and service quality need to be included in this model. Information quality is measured in terms of accuracy, timeliness, completeness, relevance and consistency of the information provided by ERP. System quality is measured in terms of ease-of-use, functionality, reliability, flexibility, data quality, and integration of ERP (Seddon, 1997). Service quality is measured in terms of ERP service level, reliability of ERP service and responsiveness and assurance of ERP service providers. When some add-on programs are required to be included

in the ERP projects, service quality provided by the program providers and the information department will also be incorporated into this model since the add-on programs often serve as a bridge between the ERP packages and the corporate practices. This study is based on IS success model that proposed to serve as foundation for positioning and comparing IS empirical studies. The model highlights an important dimension of IS success related to service quality but fails to distinguish the roles of internal and external services (Davenport, 1998). Furthermore, the notion that MIS departments are service providers has not been well established in the IS literature; few have discussed the discrepancy of service quality between the MIS department and the interrelationship to IS success (Tsai *et al.*, 2005).

**Objectives and methodology of the study**

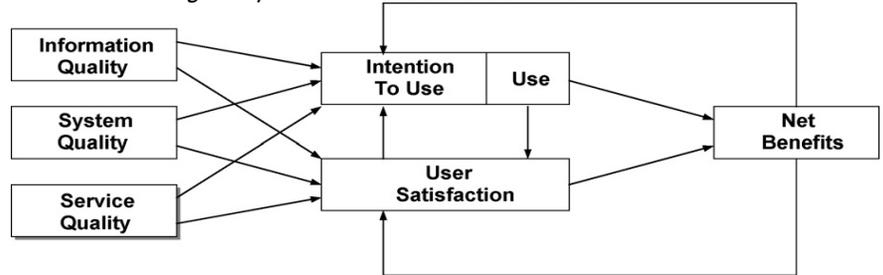
The objective of the study is to explore the concept of success model in ERP systems and to identify the factors contributing to high-quality ERP systems. A qualitative approach is used to analyze a series of events exhibiting some theoretical principles. The purpose is to examine in details the dynamics present in relevant organizations and to conceptually interpret the significance of various factors that influence the quality of ERP systems. Selection of the three organizations is based on the need to collect detailed data about the ERP implementation process in each organization. In all three cases, questionnaires were sent to 600 end-users at the three companies. A total of 228 questionnaires were answered and sent back. The response rate reads 38%. After questionnaires with incomplete answers were deleted, 202 questionnaires remained for analysis. The effective return rate drops slightly to 34%. Table 1 presents essential information about ERP system implementation at the three firms as provided by these 202 end users.

**Indian industries studied**

**TI infotech:** TI infotech is an information technology company in Noida, New Delhi, India. It specializes in ERP implementation for SAP B1 and oracle E-business suite. For tour and travel companies we have ERP "travel assist" and XML integrated online booking engine. This industry offer offshore custom software development for websites, portals, SEO activity, IT infrastructure consultancy and hosting solutions for websites and emails. It has expertise in industry like travel tour, trading, manufacturing, wholesale distributions, logistic service providers, FMCG, chemical, automotive and pharmaceuticals.

**BPCL:** In November 2001, Bharat Petroleum Corporation Limited (BPCL), a leading player in the Indian petroleum industry, successfully implemented an enterprise resource planning (ERP). Implementation began in April 2000 after the company decided to integrate all its

Fig. 1. Updated D&M IS success model



activities through the ERP package SAP R/3 the Company hoped to speed up its decision-making and respond faster to customer needs through ERP. The intention was to show the differentiation in service, retain customers and help increase the business of its industrial and commercial (I&C) customers BPCL also wanted to increase its retail thrust by exploiting IT initiatives to the maximum.

**ITTI:** (formerly, Innovation Technology Transfer India) is a system integrator and software services company with core competence in the areas of enterprise business solutions (ERP implementation & support, business intelligence solutions and business integration projects); application development & maintenance services and infrastructure management services. ITTI have significant domain expertise in the manufacturing vertical (discrete & process industries), as well as CPG, retail, automotive, pharma, cement and engineering industry verticals. ITTI's project teams provide world-class consulting and software services with the objective of building enduring relationships with our customers. Based on the leading edge CMMI (Capability maturity model integration) SW model and ISO 9001:2008 standards, our multi-shore delivery capabilities have further enhanced the 'value-add', that our customer's experience, in their engagements with ITTI.

**Respondent's characteristics**

The personal information of 202 respondents was summarized as in Table 2. Noticeably, the gender ratio is 0.91:1 (male vs. female). And 77% of the respondents has bachelor's degree or above, indicating that education is a critical concern for the employment in the high-tech industry. The cases of the three high-tech firms reflect successful implementation of ERP systems. Respondents participating in this study are all system end-users, who are generally highly experienced and educated, and have been working with the companies for 5.65 years. The earliest goes to ITTI where respondents have used the system for 4.62 years (Table 3). Experientially based differences in organizational positions or the user's role in the development of the application may cause distinct reference frames. Moreover, 34% of the respondents are working in the finance and accounting department, followed by 30% in the production department, 19% in the MIS department, and 6% in both HR and sales/marketing departments (Table 4).

Table 1. TI Infotech, BPCL & ITTI on ERP systems implementation.

	TI Infotech	BPCL	ITTI
ERP system	SAP.CRM	SAP	SAP
The project phase	2000/7	2000/4	1995/10
Implementation period	6 months	9 months	6 months
The shakedown phase	(Go-live)2001/1	2001/1	1996/5
Original system	In-house MS-Access	QAD	DSC in-house MS-Access
Consultant	PwC	PwC-IBM	IBM
Implementing modules	PM, SD, FI	PP, MM, FI, CO, SD	AM, MM, PS, PD, SD, FI
Backup systems	No	Yes	No
End users	About 300	About 600	About 200
Add on	About 600	About 1300	About 1300, if plus, report about 5000
Outsourcing	Both outsourcing & self-development	Almost MIS department development	Almost MIS department development

Table 2. Profile of respondents.

	TI Infotech	BPCL	ITTI	Total
Gender				
Male	25	36	35	96
Female	24	35	26	105
Total	69	71	61	201
Education				
High school	1	1	3	5
Tertiary school	16	15	11	42
College	33	36	39	108
Graduate school or above	20	19	8	47
Total	70	71	61	202

Table 3. Comparison of experience in Industries.

	TI infotech	BPCL	ITTI	Mean
Respondent	70	71	61	
Years of exp. in ERP	3.39	4.41	4.62	4.14
Years of exp. in work	6.32	5.87	4.75	5.65

Table 4. Department profile of respondents.

Department	TI Infotech	BPCL	ITTI	Sub total
Finance & accounting	22	30	17	69
MIS	13	10	15	38
Human resource	7	5	-	12
R&D	-	2	-	2
Production management	28	10	23	61
Sales/marketing	-	5	6	11
Supporting staff	-	9	-	9
Total	70	71	61	202

**Non-response bias:** Before data analysis, the selected sample was tested for non-response bias. Given that the survey was anonymous, it could not identify those who failed to respond. It was not possible, therefore, to determine whether non-respondents differed

systematically from those who responded. As an alternative test of non-response bias, an ANOVA was administered to analyze the background of three high-tech firms to avoid the potential bias. The results revealed that both the ratio of project members/total number of employees and the ratio of approved ERP maintenance budget/annual sales report no significant differences, thereby diminishing vastly the possibility of the presence of non-response bias (Table 5).

**Research instrument and variable measurement:** The research instrument contains a series of questions to which participants mark their level of agreement/disagreement on a seven-point scale ranging from strongly agree (score = 7) to strongly disagree (score = 1). Table 6 shows a complete listing of question items.

**Variable measures:** To determine whether all question items in Table 6 could be reduced to a

smaller group of meaningful factors, a principal component analysis was conducted based on the responses obtained from all respondents. With no item dropped, seven components with Eigenvalues greater than one emerged; the best results were obtained with a varimax rotation. Results of confirmatory factor analysis indicated that a priori assumption was substantiated with a seven-factor solution and the loadings of seven components are presented in Table 7. The Kaiser-Meyer-Olkin measure of sampling adequacy reads 0.917, and the percentage of variance explained by the 10 factors is 65.05%. Table 6 shows that the Cronbach's alpha coefficients for all dimensions are greater than 0.62, indicating that the internal consistency is acceptable.

#### Data analysis

In order to compare the difference between rating service quality dimensions and rating the importance of individual items, importance ratings of individual items were grouped into the dimensions. Each dimension was then ranked according to its overall score. Analysis of quality dimensions for those three firms indicated that system quality is the most satisfactory factor as compared with others (Table 8), implying that those firms are satisfied with the system function of SAP R3. Moreover, the means of "service quality" (5.097) is higher than that

Table 5. Non-response bias analysis.

Organizational	TI Infotech	BPCL	ITTI	F	p-Value
Project members/total number of employees a	1.274	1.186	1.366	0.931	0.396
Approved ERP maintain budget/annual sales a	1.145	1.116	1.113	0.148	0.863

a Use five-scale: 1: <1%; 2: 1 to <3%; 3: 3 to <6%; 4: 6 to <9%; 5: 39%.

Table 6. Question items.

V.1	System quality (SQ)
SQ1	Does ERP system provide up-to-date information?
SQ2	Do you get the information you need in time?
SQ3	Is ERP system accurate?
V.2	Information quality (IQ)
IQ1	Does ERP system provide the precise information you need?
IQ2	Does ERP system provide output that is exactly what you need?
IQ3	Are the output options (print types, page sizes allowed for, etc.) sufficient for your use?
V.3	Service quality (SRQ)
SRQ1	MIS employees give prompt service to users (responsiveness)
SRQ2	ERP system is dependable (reliability)
SRQ3	MIS employees have the knowledge to do their jobs well (assurance)
V.4	Behavior intention (BI)
BI1	I intend to use ERP system in performing analytical procedures
BI2	I intend to use ERP system in planning and tailoring related programs
BI3	I intend to use ERP system in electronic mode, rarely printing out copies of work papers as I proceed through my tasks
BI4	I intend to use ERP system to review decisions made by other members of the department
BI5	I intend to use ERP frequently this term
V.5	User satisfaction (USAT)
USAT1	Project satisfaction
USAT2	Information satisfaction
USAT3	User satisfaction
V.6	Benefit of use from end-users' view (BU)
BU1	Establish good relationships with the user community
BU2	Satisfy end-user requirements
BU3	Exploit IT opportunities
BU4	Be perceived as the preferred supplier of ERP products and services
BU5	Establish and maintain a good image and reputation with end-users
V.7	Net value from business' view (NV)
NV1	Enhance competitiveness or create strategic advantage
NV2	Enable the organization to respond more quickly to change
NV3	Sell appropriate ERP products and services to third parties
NV4	Ensure that ERP projects provide business
NV5	Establish and maintain a good image and reputation with management

The response scale for all statement is the following: 1= strongly disagree; 4=neutral; 7=strongly agree.

Table 9. Comparison of key success factors ratings for TI Infotech, BPCL & ITTI.

Success factor	Means	Success factor	TI Infotech	Success factor	BPCL	Success factor	ITTI
SQ	5.360	SQ	5.667	SQ	5.338	SRQ	5.097
SRQ	5.181	IQ	5.367	SRQ	5.148	SQ	5.038
IQ	5.179	BU	5.337	IQ	5.046	BI	4.997
BI	5.109	BI	5.309	BI	5.011	BU	4.984

of “system quality” (5.038) for ITTI (Table 8). This research assumed that ITTI, as the hi-tech firm that first introduced SAP R3, has trained many experienced MIS staff for maintaining the ERP system. While respondents at TI infotech considered BU has the highest usefulness, those at BPCL and ITTI argued that NV has the highest usefulness (Table 8).

**Conclusion**

Table 9 shows that the first three dominant success factors of TI infotech, BPCL and ITTI are related to the quality dimensions, suggesting that the success of implementing ERP system is largely determined by the quality dimensions. The results indicated that technological newness was the most important factor in determining the quality of the system. System quality, such as performance, flexibility of changes, response time and ease of use, is a technical issue. This result confirmed conventional wisdom that the pursuit of state-of-heart technology is a risky proposition. In addition, different aspects of system quality, such as response time, ease of use, system reliability, and flexibility of the system have been examined by IS researchers. Most of these measures are fairly straightforward, reflecting the more engineering (technical) oriented performance characteristics of the system. Researchers found that these engineering-oriented performance measures were significantly related to technical-related issues of the proposed projects. This paper proposed a success model and empirically tested the relationships between variables. In summary, this research discovered that system quality and service quality are important dimensions for measuring post-implementation ERP success. Service quality and system quality dimensions play more important roles than their information quality counterpart in terms of influencing ERP benefit of use and user satisfaction. The results not mean any CSF unimportant but it means what the respondents’

Table 8. Means and standard deviation.

Quality dimensions					
	Means	S.D.	TI Infotech	BPCL	ITTI
SQ	5.360	0.809	5.667	5.338	5.038
IQ	5.179	0.853	5.367	5.046	4.925
SRQ	5.181	0.724	5.291	5.148	5.097
Use dimensions					
BI	5.109	0.780	5.309	5.011	4.997
USAT	5.049	0.854	5.243	5.007	4.879
Benefits					
NV	5.093	0.671	5.229	5.010	5.036
BU	5.099	0.710	5.337	4.966	4.984

perceptions all about. The main issue is to manage the development process with more information about the expectations of final users.

Table 7. Results of factor analyses a.

	1	2	3	4	5	6	7	Reliability
1								
BU1	0.715							0.7955
BU2	0.630							
BU3	0.623							
BU4	0.579							
BU5	0.565							
2								
BI1		0.789						0.8277
BI2		0.652						
BI3		0.637						
BI4		0.522						
BI5		0.475						
3								
USAT1			0.641					0.6659
USAT2			0.560					
USAT3			0.541					
4								
NV1				0.596				0.6299
NV2				0.556				
NV3				0.434				
NV4				0.531				
NV5				0.402				
5								
SRQ1					0.703			0.6628
SRQ2					0.576			
SRQ3			0.406	0.512				
6								
SQ1						0.851		0.6612
SQ2						0.545		
SQ3						513		
7								
IQ1							0.649	0.6212
IQ2							0.648	
IQ3							0.485	
% of variance	12.785	11.631	10.492		9.383	8.137	6.835	5.791
Cumulative%	12.785	24.416	34.908	44.291	52.428	59.263	65.054	

## References

- Bradford M and Sandy R (2002) Realizing value in ERP. *J. Cost Management.* 13-19.
- Davenport TH (1998) Putting the enterprise into the enterprise systems. *Harvard Business Rev.* 121-132.
- De Lone W and McLean E (1992) Information system success: the quest for the dependent variable. *Information Systems Res.* 60-95.
- De Lone W and McLean E (2003) The De Lone McLean model of information system success: A ten-year update. *J. Management Information Systems.* 3-9.
- Hong KK and Kim YG (2002) The critical success factors for ERP implementation: an organizational fit perspective. *Information Management.* 25-40.
- Rai A, Lang SS and Welker RB (2002) Assessing the validity of IS success models: An empirical test and theoretical analysis. *Information Systems Res.* 50-69.
- Seddon PB (1997) A respecification and extension of the DeLone and McLean model of IS success. *Information Systems Res.* 240-253.
- Tsai WH, Chien SW, Fan YW and Cheng JM (2005) Critical management issues in implementing ERP: empirical evidences from Taiwanese firms. *Int. J. Services Standards.* 299-318.