

Enterprise Resource Planning in Technical Educational Institutions: Benefits and Cost

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Abstract— Enterprise Resource Planning (ERP) systems are widely used in technical educational institutions (TEIs) since last two decades. Though many benefits are expected from success of ERP implementation but overall success depends on various cost factors involved. The objective of this paper is to identify various benefits and costs associated with enterprise resource planning implementations in various universities. Cost benefit models (CBM) has been designed to show the relationship among various costs and benefits in ERP systems in TEIs.

Keywords—Enterprise resource planning; cost benefit analysis; customization; training

I. INTRODUCTION

ERP systems are becoming an integral part of TEIs. Many TEIs have implemented ERP systems for many benefits: to replace the older legacy systems with centralized ERP systems, to modernize the campus IT environment, for better services for students and staff, for better information for management and planning, to have the potential to decrease business risk and to increase revenues by lowering costs through improved efficiency. However all the benefits as perceived by users or promised by vendors are not actually achieved in reality. One of the reason for ERP system failure from management point of view is cost overrun. It is important to settle down the costs during the ERP implementation. Any university using ERP must be prepared to change the way in which it manages core administrative functions. In order to do this successfully it must also be prepared to tackle this as a major change management project. The researchers found that default settings were accepted during ERP implementation and change often took place through a process of default rather than choice. The issue of default settings versus the maintenance of existing processes raises important questions of competitive advantage for universities in deciding whether to implement ERP and how they should go about doing this. Universities have used ERP implementation as a building block for more advanced applications, such as e-commerce systems and portal technologies [1,2]. This has lead to spending of millions of dollars for ERP implementations. In a study, it is found that throughout the United States a number of universities have spent, at least \$5 billion dollars on ERP software [2]. Many companies purchase ERP software from an ERP vendor. There are five main ERP system vendors which

are successful in ERP market. These are SAP, Oracle, JD Edwards, People Soft and BAAN [3].

A large number of case studies have been done by many researchers for ERP implementation in TEIs (or universities). Most of the studies have identified critical success factors for ERP implementation which include costs and benefits. No analysis has been done to relate how the costs and benefits are related for successful ERP implementation in TEIs. The present research has been taken with the following broad objectives:

1. To identify the major costs and benefits considered important in TEIs for ERP implementation.
2. To propose a cost-benefit model for successful ERP implementation in TEIs

Literature survey is done to find an answer to the first research objective. A questionnaire is designed to find the important costs and benefits of ERP implementation in two Indian universities. Factor analysis followed by regression analysis has been used for proposing a cost-benefit model of ERP which can be used in TEIs.

II. RESEARCH APPROACH

As a case study, data was collected from 100 users including technical users and the faculty members for getting an insight into the cost benefit analysis for ERP system. A questionnaire was used as the research instrument. The questionnaire had two sections. One related to various costs in ERP system and the other covering all the benefits to users with the use of ERP system. A total of 11 major costs identified from the literature survey were included in the questionnaire. The tangible and intangible benefits which are supposed to be observed with the use of ERP system were identified and a total of 09 benefits were included in the questionnaire. The sample size included 40 technical people and 60 users. Due to confidentiality issues, exact values for costs and benefits was not provided by respondents in monetary terms. So the amount of efforts or time was taken as the unit for giving the inputs for costs and benefits. The present study uses a five point Likert scale for getting the inputs, where 1 represents the lowest and 5 represents the highest.

RESEARCH FINDINGS

The costs considered important for ERP system are cost of training and cost of developing interfaces[4], cost of technology[5], cost of customization[6], cost of updates[7], cost of integration[6], cost of standardization and cost of change management[8], cost of risk management, cost of regular monitoring and cost of ERP consultant[1]. The benefits for ERP system are categorized as technical benefits and user benefits.

1. **Reliability:** The reliability of the questionnaire has been checked using measuring Cronbach Alpha. Each value more than 0.7 indicates high reliability. The results are summarized in table 1.

Table 1: Reliability Analysis

Section	Number of items	Cronbach Alpha
Cost	11	0.799
Benefits	9	0.762

Factor analysis has been used to derive the significant factors for cost and benefits. The results of the factor analysis is shown in table 2.

2. Factor analysis

The benefits achieved from ERP implementation in TEIs is a good indicator of success of ERP system. Nine variables considered for benefits were reduced to two factors viz. (i) technical benefits and (ii) user benefits. The technical benefits highlights the benefits which the management of any TEI can achieve with ERP implementation. These include organizational culture, competitiveness, system stability and improves IT skills of the employees. The user benefits factor highlights the benefits to ERP users in TEIs. The benefits in this category are system security, user satisfaction, better coordination and communication, improved data quality, and enhanced flexibility of the system. Factor analysis results are shown in table 2.

Table 2 Factor Analysis for Benefits

Factor Loading	Technical Benefits	User Benefits
Organizational Culture(B9)	0.656	
Competitiveness(B5)	0.820	
System stability (B10)	0.900	
Improved IT skills of employees(B11)	0.906	
Enhanced flexibility of system (B8)		0.373
User satisfaction(B6)		0.455
Better Coordination and communication(B4)		0.519
Improved data quality(B3)		0.649
System security (B7)		0.821

Discussion: The overall benefits were judged by two sub factors for benefits namely a) technical and b)user. The sub

factors in technical benefits included improved IT skills of employees, system stability, competitiveness[9] and organizational culture[10, 11]. The sub factors in user benefits included enhanced security and flexibility of the system[6], improved data quality[1], better coordination and communication[12] and user satisfaction [4,13].

Regression Analysis

Based upon factor analysis, the overall benefits have been classified as technical benefits and user benefits. Further multivariate regression analysis has been used taking factors viz. technical and user benefits as dependent variable and various types of costs as independent variables.

3.1 Regression Analysis for Technical Benefits

The regression analysis results depict R value as 0.924 and adjusted R² value as 0.835. This model is able to predict 83.5 % of variation. Predictors of the models are cost of developing interfaces, cost of training, cost of customization, cost of integration, cost of standardization and cost of change management. The results are shown in table 3.

Table 3 Regression Analysis for Technical Benefits

Var	B	Std Error B	β	T	Sig.
(Constant)	-10.342	1.542		-6.705	0.001***
Cost of developing interfaces(C1)	1.337	0.394	0.685	3.396	0.001***
Cost of training(C2)	1.064	0.149	0.944	7.124	0.001***
Cost of technology(C3)	0.118	0.214	0.089	0.551	0.583
Cost of customization(C4)	-1.228	0.190	-0.886	-6.448	0.001***
Cost of updates(C5)	-0.469	0.220	-0.445	-2.131	0.036*
Cost of integration(C6)	0.846	0.185	0.611	4.574	0.001***
Cost of standardization(C7)	0.626	0.176	0.391	3.558	0.001***
Cost of change management(C8)	0.387	0.095	0.290	4.068	0.001***
Cost of risk management(C9)	0.157	0.141	0.062	1.114	0.268
Cost of regular monitoring(C10)	-0.152	0.076	-0.100	-1.982	0.051*
Cost of ERP consultant(C11)	-0.085	0.060	-0.082	-1.417	0.160

R=0.924 Adj. R² =0.835 F=46.431 p<.001

The regression results show that p-level is highly significant. Cost of developing interfaces is reported to be most significant factor in technical benefits factor. Cost of customization, cost of updates and cost of regular monitoring are reported to be negatively correlated with technical benefits factor. The F test of mode is highly significant and R² value is 0.853. The linear regression model equation (1) for technical benefits (TB) can be written as

$$TB = -10.342 + 1.337*C1 + 1.064 * C2 + 0.118*C3 - 1.228*C4 - 0.469 * C5 + 0.846 * C6 + 0.626 * C7 + 0.387*C8 + 0.157*C9 - 0.152*C10 - 0.085*C11. \quad (1)$$

3.2 Regression Analysis for User Benefits

The regression analysis results depict R value as 0.894 and adjusted R² value as 0.774. This model is able to predict 77.4 % of variation. Predictors of the model are: cost of developing interfaces, cost of technology, cost of customization, cost of updates, cost of integration, cost of standardization and cost of change management. The results are shown in table 4:

Var	B	Std Error B	β	T	Sig.
(Constant)	-0.269	1.804		-0.149	0.882
Cost of developing interfaces(C1)	-1.466	0.460	-0.751	-3.183	0.002
Cost of training(C2)	-0.193	0.175	-0.172	-1.107	0.271
Cost of technology(C3)	2.449	0.251	1.855	9.775	0.000
Cost of customization(C4)	-1.300	0.223	-0.938	-5.835	0.000
Cost of updates(C5)	1.610	0.258	1.527	6.248	0.000
Cost of integration(C6)	-2.195	0.216	-1.587	10.150	0.000
Cost of standardization(C7)	0.928	0.206	0.580	4.512	0.000
Cost of change management(C8)	-0.315	0.111	-0.236	-2.834	0.006
Cost of risk management(C9)	0.479	0.165	0.189	2.910	0.005
Cost of regular monitoring(C10)	-0.170	0.089	-0.112	-1.901	0.061
Cost of ERP consultant(C11)	0.037	0.070	0.036	0.524	0.602

R=0.894 Adj. R² =0.774 F= 31.794 p <.001

The regression results show that p-level is highly significant. Cost of technology is reported to be most significant factor in user benefits factor. Cost of customization, cost of integration and cost of risk management are reported to be negatively correlated with user benefits factor. The F test of mode is highly significant and R² value is 0.799. The linear regression model equation(2) for user benefits (UB) can be written as:

$$UB = -0.269 - 1.466*C1 - 0.193*C2 + 2.449*C3 - 1.300*C4 + 1.610*C5 - 2.195*C6 + 0.928*C7 - 0.315*C8 + 0.479*C9 - 0.170*C10 + 0.037*C11 \quad (2)$$

Discussion: The results of the regression analysis points to several significant findings. First, it shows that in TEIs, the signs of all the regression coefficients in both the models are not positive, that is, all variables are not positively correlated with overall benefits. This result confirms other empirical findings indicating that many different cost factors are important in shaping the overall benefits. Secondly, it is

apparent that the cost of technology and cost of risk management are positively correlated to overall benefits. Also the cost of technology has the greatest impact on user and technical benefits as seen by the magnitude of the regression coefficient of this cost factor. Thirdly, the cost of customization and cost of regular monitoring are negatively correlated with overall benefits. Also the cost of customization has a large negative impact on user and technical benefits as seen by the magnitude of the negative regression coefficient of this cost factor. The reason for this could be the extensive costs for customization and regular monitoring required.

CONCLUSION

Important predictors of technical benefits are cost of developing interfaces, cost of training[6,14], cost of integration, cost of standardization and cost of change management. Important predictors of user benefits are cost of technology[5], cost of updates[7], cost of standardization and cost of risk management. Cost of customization and regular monitoring are negatively related with all benefits. Cost of standardization is found to be significant in all benefits. Attention should be given for handling these costs. Senior management commitment is needed to ensure that the change is properly managed and led[15]. So, it can be concluded that universities must decide whether to conduct expensive customization work on standard ERP systems to better match these to their own unique processes or adopt their own processes to the best practices embedded in the ERP software. Issues of customization lie at the heart of determining the costs of ERP systems for universities and it was found that customizations caused the biggest problems for institutions when implementing ERP [15,16]. The suggestion is that existing business practices and processes should be re-evaluated and the standardized processes embedded in the ERP system should be considered for use. Indeed, this is what most ERP implementers do as they adapt their organization to the system, rather than the system to their organization.

REFERENCES

- [1] Swartz , D. and Orgill, K. "Higher education ERP: Lessons learned". *EDUCAUSE Quarterly*, 2, 2001, pp. 20–27.
- [2] Kvavik, R.B. and Katz, R.N. "The promise and performance of enterprise systems for higher education". *EDUCAUSE Quarterly*, 4, 2002, pp. 1–123.
- [3] Botta-Genoulaz, V.R. and Millet, P.A. "An investigation into the use of ERP systems in the service sector". *International Journal of Production Economics* 99 (1–2),2006, pp. 202–221.
- [4] Davis, Mary Jo and Huang, Zhenyu. "ERP in Higher Education: A Case Study of SAP and Campus Management". *Issues in Information Systems* 8(1), 2007, pp. 120-126.
- [5] Vathanophasa, Vichita and Lindsay, Stuart. "Enterprise resource planning: technology acceptance in Thai universities". *Enterprise Information Systems* 3(2), 2009, pp.133–158.
- [6] Pollock, Neil and Cornford, James. "ERP systems and the university as a 'unique' organization". *Information Technology and People* 17(1), 2004, pp. 31–52.
- [7] West, Richard and Daigle, Stephen. "Total Cost of Ownership: A Strategic tool for ERP planning and implementation". *Educause research bulletin* 2004(1),2004, pp. 1-14.

- [8] Alghathbar, Khaled. "Practical ERP implementation in Government Organization". *International Conference on E-Learning, E-Business, Enterprise Information Systems, and E-Government*, 2008, pp. 343-349.
- [9] Watson, E. and Schneider H. "Using ERP in education". *Communications of AIS* 1(9), 1999, pp. 12-24.
- [10] Mehlinger, Linda Broussard. Indicators of Successful Enterprise Technology Implementations in Higher Education Business Morgan state Morgan state University, Ph.D Thesis,2006, pp. 1-147, 3216235.
- [11] McConachie, Jeanne. "The Effect of Sub-cultures on the Implementation of an Enterprise System: An Australian Regional University Perspective". *QJER*, 17, 2001.
- [12] Antonucci, Yvonne Lederer and Muehlen, Michael Zur. "Deployment of Business to Business Scenarios in ERP Education: Evaluation and Experiences from an International Collaboration". *Seventh Americas Conference on Information Systems*,2001, pp. 998-1004.
- [13] Thavapragasam, Xavier Thavaruban. "ERP Systems and User Perceptions: An Approach for Implementation Success". *Issues in Informing Science and Information Technology*, 2003, pp. 521-531.
- [14] Ghuman, Karminder, "Incorporation of ERP in Educational Institutions: An Empirical Study". International Conference on Technology and Business Management, March 26-28, 2012, pp. 318-324.
- [15] Aldayel, Abeer I., Aldayel Mashael S. and Al-Mudimigh Abdullah S. "The Critical Success Factors of ERP implementation in Higher Education in Saudi Arabia: A Case Study". *Journal of Information Technology and Economic Development* 2(2), 2011, pp. 1-16