

The Impact of Enterprise Resource Planning on Financial Performance in a Developing Country

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Abstract

In this study, we explore the impact of Enterprise Resource Planning (ERP) implementation on financial performance of firms. A literature-based model is developed to examine the relationship between ERP system status and financial performance. The empirical analyses are based on survey data drawn among 93 Iranian manufacturing firms. The finding demonstrates that the implementation of each ERP system module separately influences financial performance indicators. Besides, the results indicate that implementing complete package of ERP system might provide synergetic impact on firm's financial performance. Based on the findings, top managers, IT managers and ERP consultants may be interested in the results of this study, because it might be increase their understanding about ERP system implementation and help them to manage and control their resources more effectively due to ERP systems implementation.

Key Words: ERP, Planning, Financial, Performance, Developing Country.

Introduction

Globalization has made business more challenging by expanding markets, increasing customer expectations and competition, made additional pressure on the firms to change rapidly. As such, an integrated system is required by the business leaders, in a way that can run the whole business processes to maintain their competitive advantages and fulfill the global requirements (P. K. Dey, B. T. Clegg, & D. J. Bennett, 2010). During the past two decades, globalization expansion has made the firms worldwide to get involved in new forms of competition and to begin a dynamic business environment. In this case, the Information Systems (IS) are powerful, universal drivers of business performance and sustainable organizational growth. For keeping such competitive pressures and environmental uncertainties under control, the firms try to engage in continual improvement, speed up the product improvement cycle, ensure production flexibility and manage logistics channels. To gain these objectives, organizations are progressively implementing the ERP systems.

ERP systems are integrated information systems which can be used to manage all information, resources and function of an organization from a shared database. These systems attempt to integrate all information in one central database, then users at different organizational positions are allowed to monitor different information levels (Dechow & Mouritsen, 2005). A significant growth has been registered by the worldwide market for ERP during the last twenty years (P. Dey, Kumar., B. T. Clegg, & D. J. Bennett, 2010; Mabert, Soni, & Venkataramanan, 2000). The global ERP market's revenues were estimated at \$65 billion in 2008, \$61 billion in 2009, and \$65 billion in 2010 (D'Aquila, Shepherd, & Friscia, 2009).

Although ERP systems have many advantages and become a central point of manufacturing firms, it is risky, costly to implement and time consuming (Sweat, 1998). Moreover, most of ERP systems are designed by western vendors. It is supposed that fundamental misalignments exist between the needs and functions of western ERP systems and requirement of organizations in developing and underdeveloped countries. Thus, ERP failures occur when organizations in the countries adapt these systems (Xue, Liang, Boulton, & Snyder, 2005).

Additionally, Ngai, Law, and Wat (2008) noted that Asian firms deal with considerably different problems in comparison with the issues faced by their counterparts in developed countries. This is due to their differences in terms of management style, business models, data formats and the extent of sophistication of IT use and so on. There is also a lack of research on ERP in Asian countries, specifically in the Middle-East region (Kamhawi, 2007). Furthermore, Iran is one of the developing countries which had unbelievable growth in ERP adoption in recent years (Nikookar, Yahya Safavi, Hakim, & Homayoun, 2010). Iranian companies started to employ information systems, because of increased domestic competition and due to the increased overseas competition. Despite the introduction of ERP systems since the 1990s, there has been no ERP post implementation study in Iran (Shahin Dezdard, 2012). Although in recent years researchers attracted by ERP issues in Iran, most of these researches are in pre implementation phase of ERP, such as selecting suitable ERP system (Jahanshahi, Farhadzareh, Fotuhi, Golpour, & Mokhtari, 2013; Nikjoo, Khah, & Moghimi, 2011) or focused on critical success factors of ERP in Iranian firms (Amid, Moalagh, & Zare Ravasan, 2012; Shahin Dezdard, 2012; S. Dezdard & Ainin, 2010, 2011, 2012; S. Dezdard & Sulaiman, 2009; Salimifard, Ebrahimi, & Abbaszadeh, 2010). Therefore, there is lack of study in post implementation phase of ERP in developing countries (Dezdard and Ainin, 2012). Based on the limited references, this study intends to have a systemic view on ERP system implementation and seek to find post implementation effects of ERP on financial performance among Iranian firms.

On the other hand, improving a firm's performance is the ultimate objective of IT systems implementation. It is important to make a difference between financial and nonfinancial performance when assessing ERPs effects (Kallunki, Laitinen, & Silvola, 2011). The ability to obtain profits assessed by financial measurement such as profit margin and return on investment is called financial performance whereas, non-financial performance referred to organization efficiency which is assessed by non-financial measures like customer complaints and customer increasing rate (Hunton, Lippincott, & Reck, 2003). Thomas F Gattiker and Goodhue (2004) and Stratman (2007) noted that a systemic concept underlies ERP system modules and that the connections and interdependencies among the modules improve performance. There is a contradictory within the literature about impact of ERP's implementation and changes on performance. A. Nicolaou and Bhattacharya (2008), Hunton et al. (2003) and Wier, Hunton, and HassabElnaby (2007) reported that organizations which implemented ERPs a few years ago are nowadays performing well. Reversely, Poston and Grabski (2001) noted that, there was no significant improvement associated with residual income or the ratio of selling, and administrative expenses in each of the 3 years following the implementation of the ERP system.

Therefore, to find out the reason of this contradictory within literature, in this study, we explore the impact of ERP's implementation status on financial performance. We firstly examine the implementation status of each ERP module's influence on financial performance. Then we explore whether the implementation of ERP system as a whole, (a collection of ERP modules) influence financial performance.

Literature Review

In this section first, ERP modules are reviewed based on previous studies then financial performance measurements are discussed and finally the development of a path model based on the literature is described.

ERP System Implementation Status

Previous studies found a positive relationship between the number and extensive use of ERP modules implemented and performance (T. F. Gattiker & Goodhue, 2005; Kallunki et al., 2011; Mabert et al., 2000; Arun Madapusi & D'Souza, 2012; Poston & Grabski, 2001). A review of past studies yielded seven modules commonly cited by researchers and vendors as components of the ERP system (Anderson, Banker, Menon, & Romero, 2011; Gallagher & Gallagher, 2012; Kallunki et al., 2011; A. Madapusi, 2008; Arun Madapusi & D'Souza, 2012; Maruf, Trinh, Chan, Chan, & Chung, 2011; Palanisamy, 2008; Raif, Huseyin, & Halil, 2011; Yeh, Yang, & Lin, 2007). The seven modules are: Financial, Material Management, Sales and Distribution, Production Planning, Human Resource, Customer Relationship Management and Quality Management. A description of each of the seven modules is provided in Table 1.

Table 1. Description of ERP modules

ERP Module	Description
Financial	Constitutes the operational aspects of the general accounting and financial information for a business unit.
Material Management	Comprises all activities related with material acquisitions such as purchasing, inventory, and warehouse.
Sales and Distribution	Enables the management of all sales and distribution activities such as ordering, sales leads, promotions, competition, marketing, call tracking, planning, mail campaigns, and billing.
Production Planning	Addresses the different phases, tasks, and methodologies used in the planning of production and the process of production itself.
Human Resource	Includes all business processes required to efficiently manage a business unit's human resources needs such as personnel, payroll, recruiting, time management, training, benefits, workforce deployment and analytics, and self-service delivery.
Customer Relationship Management	Extends the scope of ERP systems to include automating functions such as sales, marketing, customer service, and collaborative order management.
Quality Management	Handles tasks involved in quality planning, inspection and control, and compliance with international quality standards to ensure that a business unit employs a unified approach to total quality management for all its business areas.

Note: Adapted from (Arun Madapusi & D'Souza, 2012)

Financial Performance

ERP systems directly improve financial performance by decreasing IT infrastructure costs (Shang & Seddon, 2002). Further, this effect is sometimes indirect through non-financial performance. However,

Velcu (2007) indicated in a field study that ERP implementation have many direct effects on financial and non-financial performance.

In the early 1990s, researchers did not find significant positive relationship between IT investment and performance because of productivity paradox. Since then, the evidence has been mixed (Kallunki et al., 2011). Poston and Grabski (2001) reported there is no relationship between ERP system implementation and financial performance whereas Hayes, Hunton, and Reck (2001) found positive effect of ERP system on performance.

Lee, Hong, and Katerattanakul (2004) divided organizational performance into two categories: financial performance and non-financial performance and they found that profitability ratios, such as return on assets (ROA) and return on investment (ROI) are most common financial performance indicators. A. I. Nicolaou (2004a) examined the long-term influence of ERP adoption on financial performance of a firm. Data were collected within 247 companies and eight financial performance indicators were utilized including ROA and ROI. The finding indicated that in the year of ERP implementation and following year after ERP implementation, ROA and ROI was impacted negatively but after two years ROA and ROI of adopting ERP firms were significantly higher than those of non- adopting firms.

While, Aral and Weill (2007) surveyed large publicly traded companies and evaluated their IT budgets using financial performance indicators including ROA and net profit margin. Their findings indicated that investment in certain IT assets explains the differences in organizational performance. They noted, Firms' total IT investment is not associated with performance, but investments in specific IT assets explain performance differences along dimensions consistent with their strategic purpose. In addition, a system of organizational IT capabilities strengthens the performance effects of IT assets and broadens their impact beyond their intended purpose.

Based on the above discussion, it is expected that ERP system implementation contributes to change in financial performance. Furthermore, four important financial measurements, which are ROI, ROA, Turnover volume and net profit margin, are used in path model that presented in Figure 1.

Systemic approach to ERP

Some of researchers believe that single ERP module implementation may improve performance over time (Hitt & DJ Wu, 2002; Klaus, Rosemann, & Gable, 2000), however a large number of studies suggest that firms improve their performance considerably when they implement a complete ERP system (Bendoly & Jacobs, 2005; T. F. Gattiker & Goodhue, 2005; Arun Madapusi & D'Souza, 2012). Further researches in other IS system implementation areas provide stronger support for systemic concept. For instance, White, Pearson, and Wilson (1999) did an empirical study on Just in Time (JIT) and they demonstrated that more complete system implementation over longer time improve firm performance. On the other hand, Galbraith suggested in his various studies that firms should integrate their front-office and back-office operations through IS-based module extensions so as to enhance performance.

Moreover, the findings from his studies suggest that firms which implement modular systems and integrate them over time will obtain improved performance benefits (J. Galbraith, Downey, & Kates, 2001; J. R. Galbraith, 1994, 1995, 2011). A mixture of Galbraith's IS-based ERP research findings show that organizations that implement one or a couple of modules of an ERP system may determine advantages that are confined to the useful part and business exercises focused by these modules. The more modules that organizations implement, the more noteworthy will be the advantages obtained from the ability to address cross-functional needs. Firms will likewise take part in constantly calibrating their ERP frameworks to better serve business needs. This double procedure of usage and calibrating is required to increase performance.

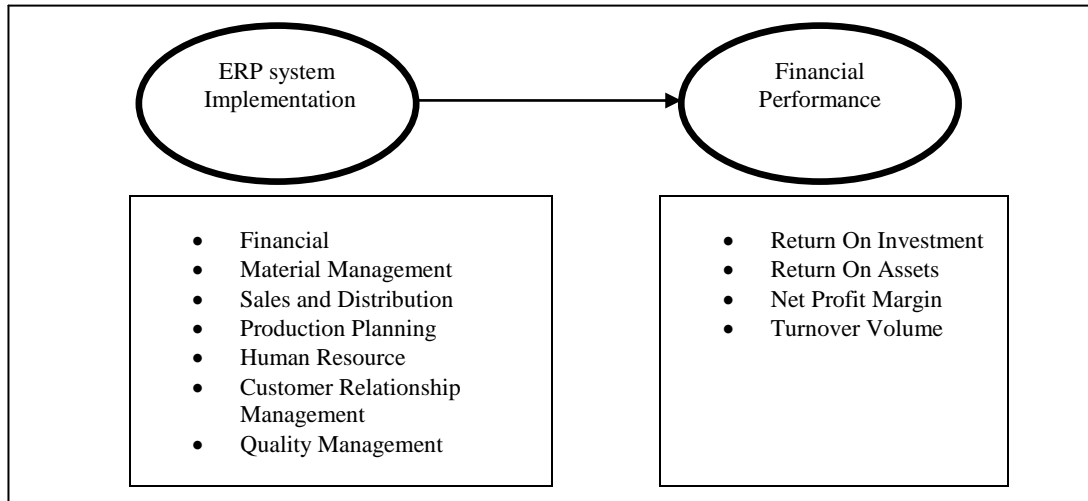


Figure 1: Impact of ERP system implementation on Financial Performance

Based on the above discussion, we investigated this phenomenon by testing the impact proposed in Figure 1 with the following hypotheses:

H1. Extensive use of implementation status of individual ERP system modules contributes to changes in financial performance.

H2. Extensive use of implementation status of holistic ERP system contributes to changes in financial performance.

Research Methodology

Sample

The data used in this study were collected by questionnaire within Iranian manufacturing firms which adopted ERP system. There was no existing database about ERP adopting companies. This means that target population of ERP adopting companies in Iran was unknown. Therefore, to find out which companies in Iran adopting ERP, various sources (World Wide Web, web sites of the top ten international ERP vendor companies, web sites of the top 30 local IS vendor companies, web sites of governmental organizations in charge of IT, web sites of non-governmental organizations in charge of IT, and published reports and articles related to ERP implementation) are used.

Finally 79 companies were shortlisted A questionnaire survey using both email and postal mail were employed. A cover letter, which explained the purpose of the research and the questionnaire, was included. The questionnaire was developed based on previous studies and it included items that assessed business unit characteristics, respondents' characteristics, ERP status implementation and financial impact of ERP system implementation. In data collection stage, all the ERP adopting companies were contacted and were asked to identify a person that we could liaise with. The liaison required to help to distribute the questionnaires to all their operational/functional/unit managers who use ERP systems. Overall, 302 questionnaires were collected from 43 out of 79 manufacturing companies. The responses from the respondents of each company, was averaged out to represent the company as the unit of analysis. The response rate was 55%.

Measures

The extent of ERP system implementation

The scale for ERP modules were drawn from White et al. (1999) and Arun Madapusi and D'Souza (2012) studies. A response scale is performed to measure the extent of each ERP modules as following range: "Not Implemented (Score 0)", "Implementation started within last year (Score 0.5)", "Implementation started more than a year and less than 3 years (Score 2)", "Implementation started more than 3 years and less than 5 years (Score 4) and finally, "implementation started more than 5 years (Score 6).

Financial Performance indicators

A combination of previous studies' methods was used to measure the financial performance of each respondent company (Kallunki et al., 2011; A. Madapusi, 2008; Arun Madapusi & D'Souza, 2012; A. I. Nicolaou, 2004b). Four performance indicators captured financial performance of a business unit. Seven-point Likert scale ranging from 1 (Strongly disagree) to 7 (Strongly Agree) was used.

Measurement Model

Structural equation model was applied to test the hypotheses. This model using the multivariate statistical method Partial Least Squares (PLS) which is suitable for small sample size studies with large number of variables (Chin, 1998). Kallunki et al. (2011) defined PLS as a set of latent vectors that performs a simultaneous decomposition of the matrix of independent variables and the matrix of dependent variables with the constraint that these latent vectors explain as much as possible the covariance between the dependent and independent variables. Although PLS provides estimation for parameters for links between variables and their constructs as well as path coefficients at the same time, a PLS model should be analyzed in two steps: firstly reliability and validity measurement model assessment, and secondly by assessment of structural model (Hulland, 1999).

In this study, for each of selected ERP modules one separate model was run and finally for impact of holistic ERP on performance, another separate model was measured. The multi item variables were tested within measurement of PLS to assess construct validity. In connection with convergent validity, the items that had outer loading less than 0.7 were deleted from their construct and then the PLS model was run without deleted items. Another important measurement to establish convergent validity is the average variance extracted (AVE) which is shown for multi item constructs and it must be greater than 0.5 (Hulland, 1999).

The internal reliability for each PLS model was tested with composite reliability statistic and the range of $0.6 < \rho < 0.95$ was expected (Hair Jr, Hult, Ringle, & Sarstedt, 2013). The Fornell-Larcker criterion is a conservative method to assess discriminant validity. Fornell and Larcker (1981) suggested to examine discriminant validity with comparison between latent variable correlations and the square root of the AVE values. Particularly, the square root of each of AVE's construct should be greater than its highest correlation with any other construct.

Structural Model Results

Table 2 shows Indicator loadings, Composite reliability, AVE, R^2 and correlation coefficients between the constructs, which were between ERP modules and financial performance. The correlation coefficients between constructs indicate that all coefficients were significant except Material Management and quality Management. In other words, the results indicate that more extensive of ERP module implementation contributes to change in financial performance.

Table 2. PLS model results for individual ERP module implementation

Impacts of modules on Financial Performance	Indicators	Loading	Composite Reliability	AVE	R ²	t value
Financial	Profit	0.9295	0.9137	0.7277	0.1026	2.68*
	ROI	0.877				
	ROA	0.8767				
	Turnover	0.7135				
Material	Profit	0.947	0.9189	0.7402	0.114	1.99
	ROI	0.89				
	ROA	0.7815				
	Turnover	0.813				
Sales	Profit	0.9349	0.9204	0.7442	0.229	5.4***
	ROI	0.9133				
	ROA	0.783				
	Turnover	0.8097				
Production	Profit	0.9218	0.9123	0.7241	0.12	2.69**
	ROI	0.8753				
	ROA	0.8869				
	Turnover	0.7029				
HR	Profit	0.9374	0.9197	0.7421	0.311	7.49***
	ROI	0.8997				
	ROA	0.8182				
	Turnover	0.7815				
CRM	Profit	0.942	0.9198	0.7426	0.215	5.59***
	ROI	0.9021				
	ROA	0.7795				
	Turnover	0.8133				
Quality	Profit	0.9199	0.9193	0.7416	0.071	1.39
	ROI	0.9429				
	ROA	0.7856				
	Turnover	0.7836				

Notes: ***, ** and * indicate significant at 1%, 5%, 10% respectively.

Table 2 also illustrates the structural relations between constructs and the level of significance as well as percentage of variance explained. The results show that composite reliability for all the constructs was acceptable and Cronbach alpha was 0.83. The final path model was estimated with data from 43 different manufacturing firms, which had complete data. Further, to achieve confidence intervals, 200 samples were used to bootstrapping re-sampling method. The results in Table 2 further indicate that, implementation of individual ERP modules (Financial, Sales and Distribution, Production Planning, Human Resources and Customer Relationship Management) increase financial performance. Human resource had the biggest percentage of variance explained (31%) and this followed by sales and distribution with 22.9%. Therefore, H1 was supported.

Table 3 presented the results of path model of the impact of holistic ERP system implementation on financial performance. In this analysis, Quality Management, which had an outer loading less than 0.6, was omitted from the path model.

Table 3. PLS model results for holistic ERP system implementation

Variables	Indicators	Loading	Composite Reliability	AVE	Cronbach Alpha	R2	t value
Financial Performance	Profit	0.9389	0.9198	0.7425	0.8833	0.225	6.17***
	ROI	0.9004					
	ROA	0.8119					
	Turnover	0.7865					
Holistic ERP System Implementation	CRM	0.9202	0.909	0.8048	0.951		
	Financial	0.9092					
	HR	0.9685					
	Material	0.7568					
	Production	0.9036					
	Sales	0.91					
	Quality						

Notes: ***, ** and * indicate significant at 1%, 5%, 10% respectively.

The results reported in Table 3 indicate that, within the path model, holistic ERP system implementation positively impacted financial performance. The R^2 was 22.5%, even though it only explains 22.55 of the variance, it is considered acceptable. In sum, our finding supports H1 and H2. The result indicates that the implementation of ERP systems may increase financial performance of manufacturing firms.

Discussion and Conclusion

A significant growth was registered by the worldwide market for enterprise resource planning (ERP) during the last twenty years (P. Dey, Kumar, et al., 2010; Mabert et al., 2000). Today, ERP vendors are trying to find new markets in developing countries. Prior research showed that, the ERP implementation was more challenging in developing countries in compare to developed countries, because most of the ERP systems are designed in developed countries. The literature indicates very much more researches have been conducted among developed countries than among developing countries, specifically in the Middle-East region (Kamhawi, 2007; Ngai et al., 2008). Furthermore, there is a lack of study in post implementation phase of ERP in developing countries (Shahin Dezdar, 2012).

The aim of this study was to explore the post implementation of ERP systems and the focus was on financial performance in Iran, a developing country. It was hypothesized that the implementation ERP systems significantly improve performance over time (Hunton et al., 2003). Firms should be able to translate these benefits into financial and non-financial performance (Kallunki et al., 2011; A. Nicolaou & Bhattacharya, 2008; A. I. Nicolaou, 2004b; Velcu, 2007; Wier et al., 2007).

In this study, to explore the impact of ERP implementation (individual and holistic) on financial performance, two different path models were estimated. The data were gathered within Iranian manufacturing firms and the results support previous arguments (Cotteleer & Bendoly, 2006; T. F. Gattiker & Goodhue, 2005; Kallunki et al., 2011; A. Madapusi, 2008; Arun Madapusi & D'Souza, 2012) that ERP system implementation is significantly related to financial performance over time.

Based on the relationship of ERP system implementation status and financial performance, this study contributed to the existing knowledge by investigating each of performance indicators. Additionally, the

result of this study supported the significant impact of ERP system implementation on financial performance and provides some contributions. The estimated path model results have gave two main insights. First, extensive use of implementation status of individual ERP modules contributes to change in financial performance. In other words, as the implementation status of ERP module increase, financial performance is positively influenced. These suggest that, the positive impact of ERP module implementation on financial performance is happen over time. Second, extensive use of implementation status of holistic ERP system provides a synergy derived to improve financial performance. These suggest that, implementation of holistic ERP systems provides greater systemic benefits than modular Implementation.

Based on the findings of the study, top managers, IT managers and ERP consultants may be interested in the results of this study, because it increases their understanding about ERP system implementation and help them to managem and control their resources more effectively to implement ERP systems. In general, this study provided a image of a firm after ERP system implementation and it might be help to making decision for the managers in pre implementation phase of ERP.

The findings support previous arguments (Cotteleer & Bendoly, 2006; T. F. Gattiker & Goodhue, 2005; Kallunki et al., 2011; A. Madapusi, 2008; Arun Madapusi & D'Souza, 2012) that ERP system implementation positively impact financial performance. Our finding confirmed that the firms which implemented holistic ERP systems reached greater financial results than modular implementation. It is suggested to managers who want to implement ERP systems to implement a package of modules to improve financial performance.

This study just focused on Iranian manufacturing firms, therefore the findings may not be generalized to other industries in the country. For instance, service sectors were not included; hence further research is suggested to be conducted among service firms. There was a lack of information on the ERP adopting companies in Iran. Indeed, there was no report on any Iranian private or public organizations on that have implemented or were in the process of implementing an ERP system. As the result sampling frame was based on previous studies on ERP in Iran. Thus, the number of cases was just 43 companies. Consequently with this small size of sample, it was impossible to estimate complicated model with large amount of constructs. Further research is suggested to divide performance in nonfinancial and financial and use both dimension of performance in one model. Further, study of Critical Success Factor as a moderator in these model types is suggested. We hope the further research use the bigger sample and service sector as well to model the impact of ERP.

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