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Investigate impact of enterprise resource planning on socio-technical elements in SAIPA Automotive Corporation (Tehran, Iran)

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ABSTRACT

The purpose of this study was investigating the most important socio-technical elements that are related with enterprise resource planning (ERP) implementation. We identify the four important socio-technical elements that may impact on organization when implementing an ERP system for the purpose of realizing the best possible return on investments. Data for this study were obtained a survey instrument. Results of the study confirmed the positive and significant impact of ERP implementation on improvement of socio-technical elements.

Keywords: *Enterprise resource planning (ERP), Socio-technical elements, Information Sharing, Organizational culture, Process improvements, Customer satisfaction*

1.0INTRODUCTION

In order to deal with a rapidly changing external environment and overcome the limitations of legacy systems, many companies have implemented enterprise resource planning (ERP) systems. ERP is a software package that uses database technology to automate, control, and integrated all the information related to a company's business including customer, supplier, product, employee, and financial data (Garg, 2010). ERP systems affect organizations and are implemented to enhance organizational effectiveness. However, ERP implementation is complex, costly and the research to date on results of ERP investments on organizational performance have been inconclusive (Etezady, 2008). Currently, the overall resources of the firm can be integrated through ERP (Berchet and Habchi, 2005). There are negative consequences when a new and very expensive technological implementation, such as an ERP system, fails to accomplish expected results. Many medium and large organizations do not recognize the delicate balance between the social structure and technical attributes of organization-wide systems (Garg, 2010).

ERP systems provide a way to address the important of human behavior in both industrial and nonindustrial organizations. The chief claim of the ERP system developers is that an ERP system will increase efficiency and profitability while simultaneously increasing the level of control a company has over its entire operation (Glasgow, 2002). Proponents of this study believe that social aspects of an ERP implementation are as important as the technological aspects (Cherns, 1987; Mumford, 2006; Trist, 1981).

This study investigated four socio-technical elements that may be improved by implementation an ERP system in the organization.

The following STS characteristics were considered:

1. Information sharing
2. Organizational culture
3. Process improvements
4. Customer satisfaction

Efficient organizations tend to focus on gradual changes in process improvements and organizational performance, and look for opportunities to add value to their customers (Hwang, 2011). Successful ERP system implementations require and organization to align itself with demands of the software, a step-by-step

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implementation plan developed through cross-functional coordination and dealing with a variety of issues relating to employee culture (Huq et al., 2006). Many researchers have mentioned a direct relationship between IT investment and organizational performance. However, research on the ERP benefits is often contradictory. Better information integration through ERP implementation provides a competitive advantage (Davenport, 1998; Al-Mashari el al., 200; Hong and Kim, 2002; Finney and Corbett, 2007). ERP provides two major benefits that do not exist in non-integrated systems: (1) a unified enterprise-wide view of the business that encompasses all functions and departments, and (2) an enterprise-wide database in which all business transactions are entered, recorded, processed, monitored, and reported (Yeh el al., 2007). Many recent studies have focused on ERP implementation- including the critical success factors that are involved and the pitfalls and complexities that can occur. Implementation of ERP system is not an easy task as it encompasses socio-technical aspects relating to people, organization and technology. Somers and Nelson (2004) conducted a literature review of critical success factors in successful ERP implementation. Success factors identified in the literature include support and commitment of senior management, redesign of business processes to fit the software, investment in user training, avoidance of customization, use of business analysts and consultants with both business knowledge and technology knowledge, integration of ERP systems with other business IS, and ability to build key in-house IT capabilities. Many ERP systems failed due to poor planning and management, lack of business management support (Iftikhar, 2011). Nah and Lau (2001) through a comprehensive review of the literature, found 11 factors that be critical to ERP implementation success. These factors include teamwork and composition, change management program and culture, top management support, business plan and vision, business process reengineering with minimum customization, project management, testing and troubleshooting, project champion, appropriate business and IT legacy systems. Prior literature on information technology investments suggests that strategic IT investment such as ERP give firms the ability to gain tangible and intangible benefits that help sustain operational efficiencies in the long run (Nicolaou, 2004). ERP system integrates the majority of the business processes and allows to the data in real time (O'Leary, 2000). There are also some intangible benefits that an organization may enjoy by implementation an ERP system including: better customer satisfaction, improved information accuracy and improved decision-making capability (Siriginidi, 2000).

This research may provide information for management to make more informed decisions in regard to adjusting an ERP system to better fit the needs of an organization.

Information sharing was measured as the first STS variable and one of the important factor for the success of ERP system's implementation. The integrated nature of an ERP system makes the sharing and timely delivery of information easier. Results from previous studies have shown ERP system formulated significant changes in communication and information sharing (Garg, 2010; Hwang, 2011). A good inter-organizational relationship based on trust, commitment and shared vision in necessary to encourage information sharing (Boddy and MacBeth, 2000; Sheridan, 1997).

Organizational culture is the second STS characteristic area to substantiate if the ERP system increased the degree of integration and cohesiveness. Organizational culture includes the organization's approach to managing its internal resource, organization of work, scope of decision-making, and the focus of managing its relationships with customers (Clark el al., 1987; Gerwin, 1993; Nahm el al., 2004). Organizational culture can be seen as the beliefs, values, and meaning shared by members of an organization (Hodges and Hermandez, 1999; Nahm el.al, 2004; Hendry, 1999; Carmeli and Tishler, 2004). Companies have paid heavy prices for ignoring corporate culture in their rush to implement an ERP system (Hwang, 2011).

The third STS variable was process improvements. Process improvement is the degree to which a firm enhances existing programs and procedures within its organization (Ravichandran and Rai, 2000; Pang et al., 2008). A majority of firms expect their new ERP-based system environment will enable process improvement. A successfully implanted ERP system enhances organizational capabilities including information access, process improvement and product innovation.

As the last STS variable, we measured the employee's perception of customer's satisfaction as result of ERP system implementation. Customer satisfaction is recognized as being highly associated with 'value' and is based, conceptually, on the amalgamation of service quality attributes with such attributes as price (Athanassopoulos, 2000). Salient consequences of an ERP implementation are information diffusion, enhanced manufacturing performance, customer satisfaction, and information availability for decision-making and organizational integration (Rajagopal, 2002). The successful implementation of ERP system increase competitiveness by increasing quality, reducing redundancy, speeding up processes, reducing lead times and inventory levels and increasing customer satisfaction (Shehab el al., 2004).

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1.1 research hypotheses

A basic enabler for close coordination and responsiveness is information sharing, which has been greatly facilitated by the advances in information technology (Hwang, 2011). It's expected ERP to have a positive effect on improvement information sharing. This leads to our first hypothesis.

Hypothesis 1 ($H1_0$): An ERP system does not significantly and positively impact on improvement of information sharing.

Hypothesis 1 ($H1_1$): An ERP system significantly and positively impact on improvement of information sharing
Organizational culture is known to be a critical factor in a project's success requiring significant organizational changes (Stewart, 2000). An organizations' existing culture has profound effects on the planning process, the implementation process and the operation of the completed project (Stewart, 2000). An organizational culture where the employees share common values and goals and are receptive to change is most likely to succeed in ERP implementation (Nah el al., 2001). Therefore, we enunciated the following:

Hypothesis 2 ($H2_0$): An ERP system does not significantly and positively on improvement of organizational culture.

Hypothesis 2 ($H2_1$): An ERP system significantly and positively impact on improvement of the organizational culture.

Process improvement is defined as a "series of actions taken to identify, analyze, and improve existing processes within an organization to meet new goals and objectives" (Ravichandran and Rai, 2000). These actions often follow a detailed methodology or strategic approach to produce successful outcomes. Advanced communication technologies and data managements systems play a vital role in process improvement. Cycle time is the total time needed to complete a business and is also a measure of process efficiency. The reduction of cycle time for those processes critical to the firm is the major driving force for process improvement. Through successful ERP implementation, firms can increase efficiency (e.g. process improvement). Generally, firms expect that their new ERP-based systems environment will facilitate process improvements (Harkness el al., 1996; Ravichandran and Rai, 2000; Peng el al., 2008). Therefore, we offer the following hypothesis:

Hypothesis 3 ($H3_0$): An ERP system does not significantly and positively impact on process improvement.

Hypothesis 3 ($H3_1$): An ERP system significantly and positively impact on process improvements.

ERP systems enable firms to identify exactly where the design or production process issue is occurring and to take the needed steps to make sure production of products of the supreme quality. This, in turn, will improve sales, customer satisfaction, and profits. Increased customer satisfaction and more increased value for customers are expected once the company enhances its ERP package with new module (e.g. the sales and distribution module) (Hwang, 2011). This leads to our forth hypothesis.

Hypothesis 4 ($H4_0$): An ERP system does not involve its workforce more effectively than a non-ERP system to help increase customer satisfaction.

Hypothesis 4 ($H4_1$): An ERP system involves its workforce more effectively than a non-ERP system to help increase customer satisfaction.
We used four dependent variables, each with two to four independent variables. Appendix for dependent and independent variables and survey questions specifies the relationship between dependent variables, variable characteristics, and related independent variable.

2.0 RESEARCH METHODOLOGY

2.1Sample and data collection

Structured questionnaires were used for data collection. The format and contents of these were developed from our literature review. Most measurement items were adopted from previous studies, thereby ensuring some level of reliability and validity. The draft of the questionnaire was then pre-tested by 10 Participants who were familiar with ERP implementation. We then interviewed each Participant to validate the questionnaire items, continuing refining it until all 10 Participants had fully agreed to the questionnaire items. The survey instrument represented dependent, independent, and demographic variables and was used to collect data from selected employees. These IT department employees have worked on ERP systems of SAIPA Automotive Corporation.

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The target and the sample population of this study consisted of 50 employees working on an ERP system. Generally, if the target population is 100 or less, standard sampling practice allows all members of a particular group to participate in a survey (Barlett el al., 2001). In total, 49 questionnaires were collected.

Demographic data indicate that 67.34% participants had similar job responsibilities on the non-ERP system prior to the ERP implementation. Over 32% participants have less than 25% of daily work routine on ERP system, over 22% participants have 25% to 50% of daily work routine on ERP system, over 28% participants have 50% to 75% of daily work routine on ERP system, and over 16% participants have more than 75% of daily work routine on ERP system. Over 85% participants were designated as professional or technical while only 4.6% from management designation.

Instrumentation

Questionnaire items formulated as statements on a 7-point Likert scale (ranging from "strongly disagree" to "strongly agree"). The scales used to measure the constructs and reliabilities of the scales are reported in Appendix. Survey data were entered in SPSS version 19.0 for quantitative data analysis using Pearson correlation and multiple regression analysis including analysis of variance. This survey tested the four research hypotheses.

Information sharing

Information sharing was measured with four items. The responses for the items in these scales were collected on seven points scales anchored by "strongly disagree" and "strongly agree". Reliability for the overall IS questions (α>0.92%) was calculated using Cronbach's alpha, the results of which indicated high reliability for all measures.

Organizational culture

Organizational culture was measured with four items. The responses for the items in these scales were collected on seven points scaled anchored by "strongly disagree" and "strongly agree". Reliability for the overall OC questions (α>0.81%) was calculated using Cronbach's alpha, the results of which indicated high reliability for all measures.

Process improvements

Process improvement was measured with four items. The responses for the items in these scales were collected on seven points scaled anchored by "strongly disagree" and "strongly agree". Reliability for the overall PI questions (α>0.92%) was calculated using Cronbach's alpha, the results of which indicated high reliability for all measures.

Customer satisfaction

Customer satisfaction was measured with three items. The responses for the items in these scales were collected on seven points scaled anchored by "strongly disagree" and "strongly agree". Reliability for the overall CS questions (α>0.89%) was calculated using Cronbach's alpha, the results of which indicated high reliability for all measures.

3. RESULTS

STS characteristics areas mean values; standard deviations and correlation matrix for the variables are shown in Table 1.

Table 1: Means, standard deviations, and correlation matrix

Dependent variable	IS1	IS2	IS3	IS4	OC1	OC2	OC3	OC4	PI1	PI2	PI3	PI4	CS1	CS2	CS3
Information Sharing		0.42**	0.44**	0.47**	0.34**	0.45**	0.65**	0.50**	0.40**	0.51**	0.71**	.050**	0.39**	0.45**	0.47**
Organizational Culture	0.33*	0.43**	0.42**	0.73**		0.51**	`0.61**	0.47**	0.35*	0.16	0.42**	0.28	0.55**	0.53**	0.54**
Process Improvement	0.40**	0.50**	0.34*	0.46**	0.35*	0.21	0.29*	0.56**		0.62**	0.71**	.51**	0.56**	0.51**	0.47**
Customer Satisfaction	0.39**	0.82**	0.51**	0.57**	.0.55**	0.42**	0.42**	0.56**	0.56**	0.61**	.051**	0.67**		0.80**	0.56**
Mean	4.22	4.82	5.47	5.51	5.69	4.67	5.33	4.85	5.13	4.75	4.98	4.68	5.27	5.18	5.29
SD	2.03	2.27	1.49	1.54	1.31	1.58	1.57	1.84	1.55	1.37	1.46	1.72	1.44	1.22	1.40

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

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Multiple regression analysis was used to test the hypothesis. The use of multiple regression requires certain assumptions about the data, especially in relation to distributional characteristics. Data screening was conducted to ascertain that relevant assumptions for multiple regressions. First, the variance inflation factor (VIF) of each predictor in the regression model was examined to assess multicollinearity. All the VIF values were less than 3. These results indicate the multicollinearity was not a serious problem. Second, data was tested for normality. Using Kolmogorov-Smirnov test, it was found that the data approximately followed a multivariate normal distribution.

Table 2: Result of hypotheses

Hypothesis 1		Hypothesis 2		Hypothesis 3		Hypothesis 4	
Variable	β	variable	B	Variable	β	Variable	β
IS2	0.24 (1.31)	OC2	0.32^{**}(2.28)	PI2	0.67^{**} (3.34)	CS2	0.94^{***}(0.94)
IS3	- 0.35 (-1.27)	OC3	0.12 (0.95)	PI3	0.01 (0.07)	CS3	-0.03 (-0.03)
IS4	0.72^{**}(2.76)	OC4	0.16 (1.64)	PI4	0.04 (0.01)		
R	0.57		0.62		0.61		0.78
R^2	0.33		0.39		1.29		0.60
F	6.06		9.13		8.06		35.45
Sig	0.002		0.000		0.000		0.000
Depend variable: IS1		Depend variable:OC1		Depend variable:PI1		Depend variable: CS1	

The numbers in parentheses are t-values.
* p< .05.
** p< .01.
*** p< .001.

4. HYPOTHESIS TESTING

A summary of the results from testing the four hypotheses are presented in Table 2. for hypothesis 1, a significant difference between Information Sharing (IS1) and a model containing three informational sharing sub-constructs IS2, IS3, and IS4; (R= 0.57, p< 0.001). The coefficients for the predictor variable are listed in the column labeled β in table 2. IS4 makes the strongest unique contribution in explaining the criterion variable (β=0.32, p<0.01). Since the observed significance level is less than 0.01 and the F ratio is large (6.06), the null hypothesis (that an ERP system does not significantly and positively impact on improvement of information sharing) can be rejected because at least one of the coefficients is not 0.

Hypothesis 2 resulted in a significant difference between Organizational Culture (OC1) and a model containing three organizational culture sub-constructs OC2, OC3, and OC4; (R= 0.62, p<0.001). PI2 makes the strongest unique contribution in explaining the criterion variable (β=0.67, p<0.01). Since the observed significance level is less than 0.0005 and the F ratio is large (9.13), the null hypothesis (that an ERP system does not significantly and positively on improvement of organizational culture) can be rejected because at least one of the coefficients is not 0.

Hypothesis 3 resulted in a significant difference between Process Improvements (PI1) and a model containing three process improvements sub-constructs PI2, PI3, and PI4; (R=0.61, p<0.001). OC2 makes the strongest unique contribution in explaining the criterion variable (β=0.72, p<0.01). Since the observed significance level is less than 0.0005 and the F ratio is large (8.6), the null hypothesis (that an ERP system does not significantly and positively impact on process improvement) can be rejected because at least one of the coefficients is not 0.
Hypothesis 4 in a significant difference between Customer Satisfaction (CS1) and a model containing two customer satisfaction sub-constructs, (R= 0.60, p<0.001).). CS2 makes the strongest unique contribution in explaining the criterion variable (β=0.94, p<0.001). Since the observed significance level is less than 0.0005 and the F ratio is large (35.45), the null hypothesis (that An ERP system does not involve its workforce more effectively than a non-ERP system to help increase customer satisfaction.) can be rejected because at least one of the coefficients is not 0.

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5. DISCUSSION

This is the first study in Iran to measure important socio technical systems variables as they related to implementation of an ERP system. We measured four STS variables namely (a) information sharing, (b) organization culture, (c) process improvements, and (d) Customer satisfaction, for an enterprise resource planning system. The results of the research performed in this study revealed that ERP system formulated significant changes in communication and information sharing, organizational culture, process improvement, and customer satisfaction.

The test of the first research hypothesis as laid out in table 2 suggests that ERP system has positive impact on improvement communication and information sharing. Information sharing element measured that team members are well equipped to share knowledge because of ERP system. IS4, which the ERP system's ability to improve the quality of information sharing, makes the strongest unique contribution in explaining the criterion variable (β= 0.72). Thus, the empirical results of this survey demonstrate that the ERP system has improved the decision-making process and quality of information sharing.

To test the second hypothesis we estimate if the ERP system increased the degree of integration and cohesiveness. The increased level of work redesign due to the ERP system (OC2) is the most important predictor of organizational culture and makes the strongest unique contribution in explaining the criterion variable (β= 0.32). The findings contend that ERP system's success is positively related with organizational culture. The empirical results of this study demonstrate that the ERP system has helped to improvement of the organizational culture.

Our third hypothesis examines impact of ERP on process improvements. The dependent variable PI1, related to integrate process improvements. Table 2 displayed the model summary of dependent variable PI1. PI2, which the level of teams understanding of inter-departmental work makes the strongest unique contribution in explaining the criterion variable (β= 0.67). These implications of this finding demonstrate that the organization should be concerned with improving process. Process improvement is critical and vital for organizations to succeed, especially when the organization is implementing an ERP system.

As the last hypothesis we study the impact of ERP on increase customer satisfaction. The fourth dependent variable CS1 was to measure the employee's perception of customer's satisfaction as a result of ERP system implementation. This was identified by two predictive variables: (a) employee's perception of improved team's effectiveness in working with customers (CS2), and (b) employee's perception of improved overall performance (CS3). CS2 makes the strongest unique contribution in explaining the criterion variable (β= 0.94). The ERP provides real time data to management for the front line employees serving customers. Equipped with this data available in the ERP system, and supported by desktop tools, employees can achieve higher productivity and give customers faster, and higher quality service. A better availability and understanding of the information contributes to increased customer satisfaction. This shows that the organization should provide its employees with support and device, and make available the tools and equipment to perform jobs when desiring to improve customer service.

Our findings add support to the conclusions of studies that emphasized successful ERP implementation leads to fast and real-time information sharing (Hwang, 2011; Davenport, 1998). Hwang (2011) founds fast and real-time information sharing through ERP implementation increase supplier's capabilities. These finding are also in keeping with studies that have suggested that ERP have positive impact on organizational culture (Garg, 2010; Nah el al, 2001). The empirical analysis undertaken in this study also provides support for the findings that a successfully implemented ERP system enhances organizational capabilities including process improvement (Dowlatshahi, 2005; Ravichandran and Rai, 2000; Peng el al., 2008;Garg, 2010; Hwang, 2011).Our finding is consistent with the finding of the research which indicates that ERP system has positive impact on increase customer satisfaction (Hwang, 2011; Garg, 2010).

Some of the limitations of this study may also be viewed as avenues for future research, For example we can notify the inability to include the customers in the survey to measure their satisfaction. Therefore, we were forced to name the "customer satisfaction" as the "employee's perception of the customer satisfaction. This research was carried out in an IT department of one manufacturing organization. A key suggestion for future research is to conduct this research in more than one ERP system installations so that the results could be generalized to an entire segment of industries. This could be further expanded to multiple industry sectors such as service industry, academic institutions, textile industry, or electronics industry.

The survey instrument could be used with different sampling strategies such as selecting different geographic

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regions, or industry types. Although this study kept a limited scope of analyzing demographic data, further studies could get better data reliability by further analyzing demographic data.

The cost, complexity, and implementations of an ERP system imply that organization must seriously consider the planning and selection process. Adopting newer and more advanced systems, such as an ERP system, can cut operating costs and make it easier to adopt an IS to market changes or competitive pressure.

Many organizations excessively put emphasis on the information technology. These organizations cannot afford to ignore the most important factor for ERP system implementation success, that it should be people-centered. The results of the research performed in this study revealed that ERP system formulated significant changes in communication and information sharing, organizational culture, operating process and procedures improvements, and customer satisfaction.

Appendix. Questionnaire Items

Variable Code	Variable Type	Variable Definition	Related Survey Question	Cronbach α
STS Characteristic Area= Information Sharing (IS)				
IS1	Dependent	The level of team member's ability to share knowledge	The ERP team members are well equipped to share knowledge.	0.92
IS2	Independent	The level of ERP system's perceived ability to encourages cross-team communication	The ERP system encourages cross-team communication.	
IS3	Independent	The ERP system's ability To improve the decision-making Process	The information that the ERP system provides, helps improve the decision-making process.	
IS4	Independent	The ERP system's ability To improve the quality of information sharing	Compared to a non-ERP system, the ERP system has improved the quality of information sharing.	
STS Characteristic Area= Organizational Culture(OC)				
OC1	Dependent	The degree of integration and cohesiveness due to the ERP system	The ERP system has helped us become more integrated and cohesive as an organization, overall and as work groups/teams.	0.81
OC2	Independent	The increased level of work redesign due to the ERP system	I have experienced work redesign since the ERP system implementation in my organization.	
OC3	Independent	The level of confidence and trust within teams for knowledge and support	Team members working on one ERP module have confidence and trust in their teams for knowledge and support when needed.	
OC4	Independent	The level of confidence to compete with peer organizations	With the ERP system implemented, our organization is well equipped to compete with peer organizations.	
STS Characteristic Area = Process Improvement (PI)				
PI1	Dependent	The degree of self-governance to integrate process improvements	The ERP teams feel a sense of self-governing which enables them to integrate process improvements and / or streamline operations.	0.92
PI2	Independent	The level of teams understanding of inter-	The ERP teams understand how their work relates to other jobs in	

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		departmental work	the ERP functional area or department.	
PI3	Independent	The team's level of desire to improve work processes	The ERP teams strive to make improvements in work processes.	
PI4	Independent	The ERP system's ability to improve product quality	The ERP system has improved our product quality.	
STS Characteristic Area = Employee's perception of Customers Satisfaction (CS)				
CS1	Dependent	The perception of increased level of customer satisfaction	Generally speaking, implementing the ERP system has increased customers satisfaction in my department.	0.89
CS2	Independent	The perception of increased level of effectiveness in working with customers	The ERP system has helped us improve our team's effectiveness in working with customers.	
CS3	Independent	The perception of increased level of overall performance	The ERP system has helped improve our overall performance.	

Demographic question
What is your current designation?
( ) Management
( ) Professional
( ) Technical
( ) Other

If have a professional or technical designation, what is your current work area/ function?
( ) Software development
( ) Team lead
( ) Functional/business support
( ) Other

How long have you worked on the ERP system overall?
( ) Less than 1 year
( ) 1 to 5 years
( ) 6 to 10 years
( ) 11 to 15 years
( ) Over 15 years

On average, how much do you interact with the ERP system in your daily work routine?
( ) Less than 25% of daily work routine
( ) 25% to 50% of daily work routine
( ) 51% to 75% of daily work routine
( ) More than 75% of daily work routine

Were you performing similar job responsibilities on the non-ERP system prior to the ERP implementation?
( ) Yes
( ) No

If you responded yes to previous question, how long were you performing the similar job responsibilities on the non-ERP system prior to the ERP implementation?
( ) Less than 1 year
( ) 1 to 5 years
( ) 6 to 10 years
( ) 11 to 15 years
( ) Over 15 years

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