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An Investigation into Post-Implementation Success of ERP: An Empirical Study of the Chinese Retail Industry

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Abstract

Significant growth in the Chinese retail industry has boosted utilization of Enterprise Resource Planning (ERP) systems among Chinese retailers. However, due to the weak information infrastructure of organizations and the inherent complexity of ERP systems, many Chinese retailers have encountered difficulties in achieving the benefits at the *post*-implementation stage of the ERP deployment. The *post*-implementation success of the ERP is under researched, though. Therefore, based on the Technology-Organization-Environment (TOE) theory, we develop an integrated model of the *post*-implementation success of ERP, and empirically test it in the Chinese retail industry. The results show that implementation quality and organizational readiness positively affect the *post*-implementation success of the ERP, while external support does not exert significant impacts. The research and practical implications of the findings are discussed.

Keywords

Enterprise Resource Planning, Post implementation success, Chinese retail industry

INTRODUCTION

Enterprise resource planning (ERP) systems have been increasingly adopted by Chinese organizations across industries. Nevertheless, many Chinese organizations have been puzzled at how to effectively deploy the ERP system to generate benefits, yet little research has been devoted to this issue. Therefore, this study attempts to fill this gap by studying factors facilitating *post*-implementation success of ERP in the Chinese retail industry.

The Chinese retail industry has a rapid growth: the total volume of retailing has increased at an annual rate of over 12% in the last five years. Despite such accomplishments, Chinese retailers' operational efficiency is still lower than their counterparts' in developed countries in such indicators as sales costs and turnover of current capital. One main reason for this discrepancy is Chinese retailers' lack of an efficient information system. Realizing this weakness, many Chinese retailers have begun to adopt ERP systems in the hope of improving their operational and managerial levels.

An ERP system is defined as "configurable information systems packages that integrate information and information-based processes within and cross functional areas in an organization" (Kumar and Hillegersberg, 2000, p.22). It has been believed to bring great benefits to Chinese organizations, e.g., reducing inventory levels, enhancing customer services, and increasing profit margin. (Martinsons, 2004).

Nevertheless, after a rush of implementing ERP systems, many Chinese organizations have learned that the ERP system did not bring the expected benefits; rather, for some organizations it resulted in unsatisfactory profitability and high inventory levels (Benchmarking Partners Inc., 1998). Successful ERP deployment requires extensive knowledge, better control of resources, and coordination among interest groups (Nah, Zuckweiler and Lau, 2003). Many Chinese retailers lack knowledge and experience in deploying a large information system. Besides, retailers have a critical demand on management of customer relationship and daily transactions, not yet emphasized by ERP systems. Thus, Chinese retailers have difficulties in achieving *post*-implementation success of ERP.

The *post*-implementation of ERP has been an under-researched topic (Esteves and Bohorquez, 2007), yet obtaining benefits and continuous improvement from *implemented* ERP systems have emerged as the second wave of research on ERP (Shanks, Seddon and Willcocks, 2003). Among the few, Shang (2001) and Yu (2005) propose that maintaining the fit between the

system and organizational needs, top management support, and user training are conducive to *post*- implementation benefits.

However, the results of these studies are fragmented, and none of them paid attention to the Chinese context. Furthermore, prior studies on ERP have primarily utilized a case study approach and thereby a quantitative examination of *post*-implementation of ERP is still lacking. Thus, this study is intended to fill these gaps by theoretically developing and empirically testing a research model to explain *post*-implementation success of ERP.

With the Technology-Organization-Environment (TOE) theory as the theoretical background, we identify three factors that will affect *post*-implementation success: (1) ERP implementation quality (Technological aspect), (2) organization's readiness (Organizational aspect), and (3) external support (Environmental aspect). To empirically test the research model, we conduct a field survey in the Chinese retail industry.

The rest of this paper is organized as follows. Section 2 introduces the theoretical background. Section 3 elaborates a research model and posits a set of hypotheses. Section 4 describes the research methodology. Section 5 reports the results. Section 6 discusses the results, implications for research and practice, limitations, and future research directions. Section 7 concludes this paper.

THEORETICAL BACKGROUND

In this section, we will first introduce the concept of *post*-implementation success of ERP and its operationalization, and then describe the TOE theory.

Post-implementation success of ERP

An ERP system is typically assimilated in an organization through *pre*-implementation, implementation, and *post*-implementation stages (Parr and Shanks, 2003). The *post*-implementation stage starts from the normal operation of the ERP system and lasts until the system is replaced with a new one (Nah et al., 2003). Unless *post*-implementation of ERP succeeds, successes of the previous stages of the ERP initiative are meaningless.

Because of the dynamic characteristic of ERP assimilation, success of an ERP initiative at each stage should be measured against the stage's objectives (Markus and Tanis, 2000). In this study, *post*-implementation success of ERP refers to the benefits obtained from ERP deployment, since acquiring benefits from deployed ERP systems epitomizes this concept. At the *post*-implementation stage, an organization cares much about the effectiveness of using the ERP system, which complies with the organization's expectation to adopt such a system (Al-Mashari, Al-Mudimigh and Zairi, 2003).

An ERP system influences processes at a deep degree, and thereby the benefits produced by the ERP system will be at multiple levels. In this study, *post*-implementation success of ERP is measured by both operational and managerial benefits. Operational benefits refer to those advantages brought about by the ERP system in terms of cost reduction, inventory reduction, and customer service enhancement; while managerial benefits refer to improved efficiency and effectiveness of decision making introduced by the ERP system (Shang and Seddon, 2003).

TOE theory

The TOE theory contends that assimilation of an organization-wide information system will be affected by multiple factos related to technology, organization, and environment (Tornatzky and Fleischer, 1990).

Technological aspect describes effects of characteristics of an information system on assimilation. Such characteristics include various facets of the information system, from core capabilities and quality of the system to the system's compatibility with the organization (Tornatzky and Fleischer, 1990). *Organizational aspect* refers to conditions of an organization facilitating assimilation of an information system. The conditions include an organization's overt characteristics (e.g., organization size) and subtle features (e.g., capabilities to harness the system) (Chau and Tam, 1997). *Environmental aspect* indicates that related external parties of an organization will exert effects on the focal organization's assimilation of an information system by presenting support to the assimilation (Thong, 1999).

After implementation, the ERP deployment is a process in which the ERP system gradually integrates with business and decision making processes (Mabert, Soni and Venkataramanan, 2003). As such, the TOE theory provides a comprehensive research framework to investigate the ERP deployment at the *post*-implementation stage.

HYPOTHESIS DEVELOPMENT

We propose that ERP implementation quality (Technological aspect), organization's readiness (Organizational aspect), and external support (Environmental aspect) will affect *post*-implementation success of ERP (Figure 1).

ERP implementation quality refers to the degree to which an ERP system is deployed to fulfill an organization's requirements.

Organization's readiness refers to whether an organization has made preparation conducive to effective deployment of an ERP system. External support refers to the help afforded by the surrounding organizations to help the focal organization on effective ERP deployment.

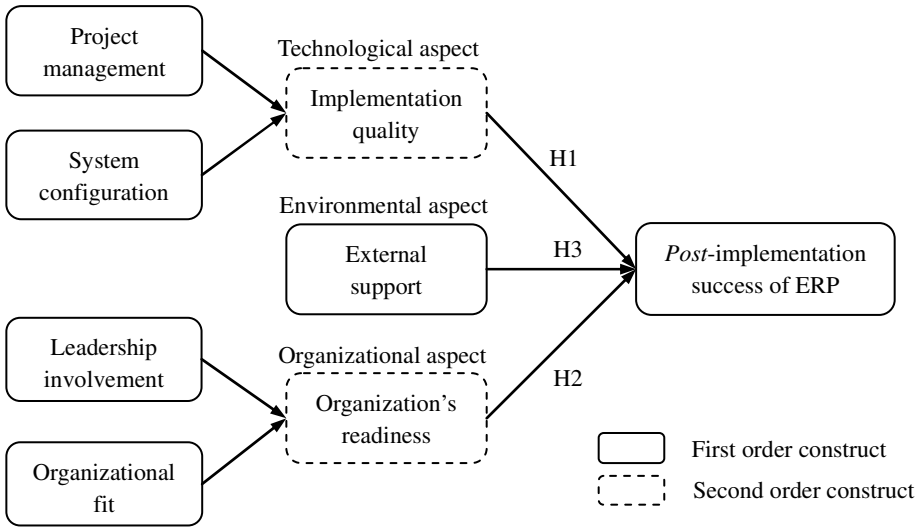

Figure 1. Research Model

ERP implementation quality

ERP implementation quality is constituted by effective project management and sound system configuration. Effective project management refers to that an ERP project can be well managed so that the ERP system will be implemented to realize expected functions within time and budget. Sound system configuration refers to establishing and maintaining consistency of ERP's functional attributes with its requirements throughout its life. The project management can organize and coordinate all the endeavors spent in implementing toward the same direction, thereby ensuring implementation quality. System configuration can streamline operation of the system and tune inputs and outputs, assuring implementation quality.

Effective project management

Effective project management makes sure that all components of the ERP system will be integrated appropriately. This fiction-free connection facilitates communication and interaction within Chinese organizations, supporting efficient managerial decision. Besides, effective project management ensures that the ERP system is implemented at a deep degree. Such increased automation relieves labors and refrains from human-made errors, thus generating operational benefits. In contrast, a poorly managed ERP project is highly correlated with re-implementation, which not only incurs additional investment but delays the ERP system in producing benefits as well (Ross, 1999). Worse, the re-implementation reduces users' morale and leads to a resistant attitude towards the ERP system, negatively affecting the users' efficacious use of the system.

System configuration

Sound system configuration first indicates a good ERP architecture describing the functional scope and application depth of an ERP system. The good architecture is helpful to streamline the logic of the ERP system (Nah et al., 2003), and further strengthens its integrated powers. Besides, sound system configuration implies a good testing of the ERP system often overlooked by Chinese organizations. It can uncover problems in advance to reduce as many breakdowns as possible in normal operation (Al-Mashari et al., 2003). In addition, sound system configuration means well configured data. Chinese organizations usually have a weak data management; Thus, with good input data, the ERP system can generate more reliable and informative information, which strengthens Chinese organizations' power to use the ERP system for decision making (Ross and Vitale, 2000).

Hypothesis 1: ERP implementation quality will be positively associated with *post*-implementation success of ERP.

Organization's readiness

Organization's readiness is composed of leadership involvement and organizational fit. Leadership involvement refers to that top management takes an active role in the *post*-implementation stage of ERP to ensure successful operation of the ERP system in the organization. Organizational fit refers to the match between an organization's practice and the requirement of an

ERP system. An ERP initiative is often called a leader-leading project, and therefore unless the top leaders actively involve themselves in the ERP initiative, it can not display that the organization has been prepared well (Willcocks and Griffiths, 1997). Besides, organizational fit implies that the organization has made efforts to make itself and the ERP system to match with each other, thus increasing the organization's readiness.

Leadership involvement

Top leaders have absolute authority in Chinese organizations, and thus they play important roles in the following aspects at the *post*-implementation stage. First, by involving in the *post*-implementation stage of ERP, top leaders can find ERP requirement and actively allocate resources to the ERP system, so that the system can run smoothly with more powerful abilities to produce benefits. Second, by putting more efforts on ERP, top leaders demonstrate their commitment towards the ERP deployment, thereby creating a favorable environment for the ERP system to generate benefits (Nah et al., 2003). Third, through participation, top leaders can know the ERP system better, and are more likely to realize the alignment between business and the system (Kearns and Sabherwal, 2006), conducive to producing benefits.

Organizational fit

Compatibilities between an organization and an ERP system can promote benefits at the *post*-implementation stage (Soh, Sia, Boh and Tang, 2003). First, Chinese organizations are weak in process management, and therefore unless Chinese organizations reengineer their processes, the "best businesses" embedded in an ERP system can not be effective (Hong and Kim, 2002), let alone producing benefits. Second, organizational fit also demonstrates itself in the match between the actual users and ideal operators required by ERP. Employees of Chinese organizations lack experience in using a large-scale information system, and thus sufficient training can lead to benefits by directly improving users' skills of using the system (Mische and Beenis, 1996) and indirectly establishing users' positive attitude toward the system (Somers and Nelson, 2003).

Hypothesis 2: Organization's readiness will be positively associated with *post*-implementation success of ERP.

External support

The *post*-implementation success of ERP is also promoted by external support (Markus and Tanis, 2000), which originate from consultants, ERP vendors, and its business partners.

First, good consultants are good at configuring the ERP system at the operational and managerial levels (Wang and Chen, 2006). Thus, they can provide Chinese organizations that own little such knowledge with professional advice on the effective use of the ERP system and help the focal organizations to realize benefits.

Second, ERP vendors can provide *post*-implementation technical assistance such as system updates. These supports are crucial for Chinese organizations that lack IT strength to perfect the ERP system with cutting edge technologies to extend the system's capabilities of producing more benefits (Zhang, Lee, Huang, Zhang and Huang, 2005).

Third, business partners can support deployment of the ERP system at the *post*-implementation stage by cooperating with smooth and qualified boundary transfers, especially important for Chinese retailers that have a large data flow. By thus, synergy effects can be expected (Amrani, Rowe and Geffroy-Maronnat, 2006).

Hypothesis 3: External support will be positively associated with *post*-implementation success of ERP.

RESEARCH METHODOLOGY

Survey sample

The Chinese retail industry is chosen as the survey sample. The retail industry among the first batch of organizations with service orientation attempts ERP systems, since modern retailers need such a powerful information system to manage a variety of products and suppliers. Besides, the prior research has been mainly conducted in the manufacturing sector (Zhang et al., 2005). Thus, an investigation in a new context will extend the current theory about ERP.

Instrument development

The *post*-implementation success of ERP is measured by managerial and operational benefits obtained from ERP deployment, based on the typology for ERP benefits (Shang and Seddon, 2003). Since these two kinds of benefits are inextricably linked (Barua, Kriebel and Mukhopadhyay, 1995), *post*-implementation success of ERP is modeled as a reflective construct.

Implementation quality is modeled as a second-order formative construct composed by effective project management and sound system configuration, since a change in one sub-construct in isolation will inflict impacts on implementation quality without necessarily associating with a variation in the other (Chin, 1998). Similarly, organization's readiness is also modeled as a second-order formative construct composed by leadership involvement and organizational fit. The first-order constructs

and external support are adapted from the established measurement items (Al-Mashari et al., 2003; Umble, Haft and Umble, 2003).

All items for this study were further confirmed by the experts in retailing and ERP to ensure the content validity (Cronbach, 1971). Each item is measured on a 7-point Likert scale, with 7 representing "strongly agree" and 1 representing "strongly disagree." All measures are provided in Appendix.

Data collection

139 retailers were selected as the candidate sample from two sources: the list of top 100 Chinese retailers, and recommendations from several retail experts. A candidate retailer is required to have installed at least basic modules of the ERP package, and to apply the ERP system for at least two years to pass the stabilization period (Ross and Vitale, 2000).

Questionnaires were sent to the CIO or the IT manager in the candidate retailers. A total of 65 questionnaires were returned, with a response rate of 46.8%. The sample consists of a complete spectrum of retail types in the Chinese retail market (Table 1), and applies major current ERP brands (Table 2).

Retail type	Frequency	Percentage (%)
Hypermarket	29	29.29
Specialty store	22	22.22
Supermarket	13	13.13
Department store	13	13.13
Shopping center	6	6.06
Online purchasing	5	5.05
Membership warehouse	4	4.04
Factory outlet	3	3.03
Convenience store	3	3.03
Home furniture	1	1.01
Total	99[a]	100

Table 1. Retail type distribution of sample retailers

[a] some retailers belong to multiple retail types.

Brand	Frequency	Percentage (%)
Oracle	20	28.99
In house	17	24.64
SAP	9	13.04
Kingdee	9	13.04
Local - others	8	11.59
UFIDA	4	5.80
Foreign - others	2	2.90
Total	69[b]	100

Table 2. Brand distribution of ERP systems used by sample retailers

[b] some retailers deploy more than one ERP brands.

Measurement model

The measurement model is assessed by each construct's reliability, convergent validity, and discriminant validity. The reliability of the scale was evaluated by internal consistency analysis (Fornell and Larcker, 1981). Table 3 shows that all reliability values are well above the threshold 0.70 (Nunnally and Bernste, 1994).

	No. Items	Internal Consistency	LI	OF	PM	SC	ES	PS
Leadership Involvement (LI)	3	0.876	**0.837**					
Organizational Fit (OF)	2	0.824	0.630	**0.837**				
Project Management (PM)	4	0.845	0.680	0.540	**0.760**			
System Configuration (SC)	3	0.823	0.536	0.510	0.638	**0.786**		
External Support (ES)	3	0.843	0.453	0.311	0.554	0.494	**0.801**	
Post Success (PS)	5	0.847	0.631	0.410	0.599	0.439	0.341	**0.727**

Table 3. Construct correlations and reliabilities

Note: The diagonal elements are square roots of Average Variance Extracted (AVE).

Confirmatory factor analysis was used to test the two validities, and the results are reported in Table 4. The loading of each item on its corresponding construct is higher than the item's loading on any other construct and any other item's loading on the focal construct, demonstrating good convergent validity (Fornell and Larcker, 1981). Besides, Table 3 also shows that each construct has a square root of average variance extracted higher than the correlation between the focal construct and any other construct, displaying sound discriminant validity (Fornell and Larcker, 1981).

	Leadership Involvement	Organizational Fit	Project Management	System Configuration	External Support	Post Success
LI1	**0.852**	0.463	0.527	0.423	0.254	0.577
LI2	**0.832**	0.492	0.617	0.462	0.431	0.462
LI3	**0.828**	0.623	0.565	0.460	0.450	0.543
OF1	0.551	**0.848**	0.579	0.421	0.348	0.369
OF2	0.503	**0.826**	0.319	0.433	0.167	0.316
PM1	0.443	0.342	**0.729**	0.572	0.404	0.395
PM2	0.526	0.538	**0.835**	0.553	0.460	0.389
PM3	0.517	0.256	**0.751**	0.480	0.526	0.497
PM4	0.598	0.513	**0.720**	0.310	0.276	0.563
SC1	0.384	0.340	0.513	**0.830**	0.545	0.359
SC2	0.450	0.366	0.355	**0.790**	0.342	0.311
SC3	0.431	0.486	0.606	**0.735**	0.270	0.356
ES1	0.256	0.210	0.479	0.490	**0.794**	0.234
ES2	0.357	0.338	0.395	0.298	**0.807**	0.308
ES3	0.464	0.181	0.470	0.427	**0.802**	0.268
PS1	0.555	0.348	0.561	0.331	0.325	**0.816**
PS2	0.463	0.481	0.532	0.454	0.141	**0.776**
PS3	0.426	0.142	0.294	0.199	0.210	**0.689**
PS4	0.427	0.254	0.415	0.347	0.427	**0.760**
PS5	0.413	0.146	0.276	0.185	0.136	**0.567**

Table 4. Item loadings and cross loadings

RESULTS

A partial least squares technique was used to test the hypotheses. The final results are reported in Figure 2. The proposed research model explains 42.1% of the variance in *post*-implementation success of ERP, showing a good explanatory ability.

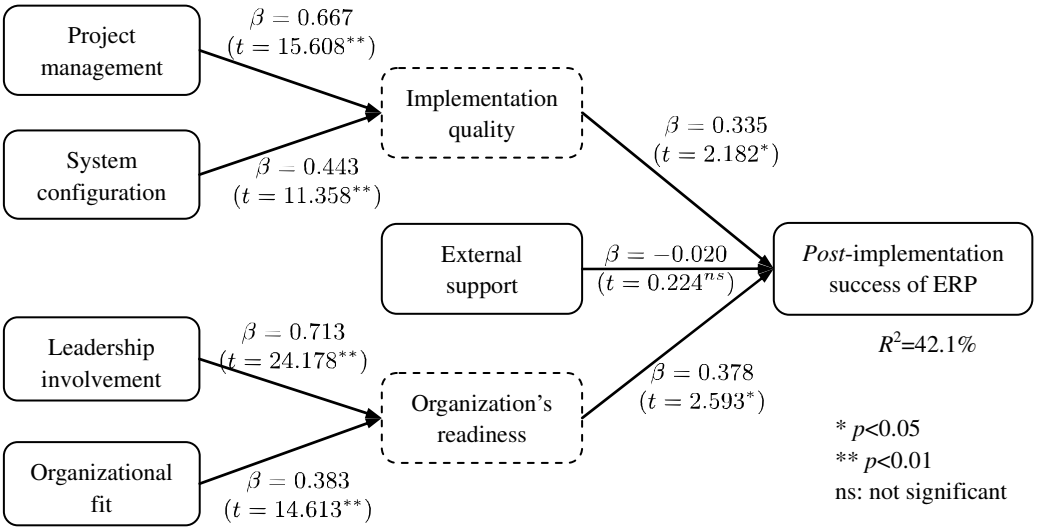

Figure 2. Results: path coefficients and statistical significance

Project management (0.667, p<0.01) and system configuration (0.443, p<0.01) have significant weights on implementation quality, and leadership involvement (0.713, p<0.01) and organizational fit (0.383, p<0.01) have significant weights on organization's readiness, indicating that the two second-order constructs are well structured. Both implementation quality (0.335, p<0.05) and organization's readiness (0.378, p<0.05) have significant path coefficients to *post*-implementation success, while the coefficient of external support is not significant. Therefore, H1 and H2 are supported, but H3 are not supported.

DISCUSSION

The insignificant effect of external support may be explained by several reasons. Since most of the sample retailers have not used ERP systems for a long time, it may not be necessary for them to request the ERP vendors' *post*-implementation assistance. Besides, the sample retailers still focus on the effective use of the system within the organization, and hence they may not perceive synergy effects with their partners. Furthermore, the sample retailers do not consider the consultant's support to be helpful, and deem that consultants lack experience and knowledge specific for the retail industry.

In order to explore whether the predicting powers of our proposed model vary with ERP brands, three ERP types, i.e., foreign, local, and in-house, are coded as two dummy variables and then added into the research model as a control variable. The result shows that the interaction terms of ERP type with any one of the three predicting variables do not display significant effects on *post*-implementation success; therefore our model is quite robust across ERP brands.

Theoretical implication

Our study represents an early research effort towards the *post*-implementation issue by proposing and testing a parsimonious research model that explains the *post*-implementation success of the ERP.

The previous research has mainly applied the TOE theory to explain implementation of an information system such as EDI (Iacovou, Benbasat and Dexter, 1995). Our study extends the applicability of the TOE theory by showing that this theory is also successful in predicting *post*-implementation success of organization-wide information systems

We identified a set of particular factors under the theoretical framework of the TOE theory for the *post*-implementation success of the ERP, i.e., organizational readiness and ERP implementation quality.

This research also displays that leadership involvement and project management play important roles across the whole ERP life cycle. The extant literature identifies these two factors as critical success factors for ERP implementation (Holland and Light, 1999; Nah et al., 2003). Our research extends these findings to the *post*-implementation stage.

Practical implication

This research also holds practical implications for ERP deployment. For example, top leaders of Chinese retailers should involve themselves in the whole process of the ERP initiative to demonstrate their commitment to ERP deployment. They also should view ERP as managerial philosophies bringing transformation rather than just a software package.

The ERP implementation consumes so much time and resources that an organization usually cannot wait for a sufficient testing but rather put it into operation as soon as possible. However, many risks can surface with this practice; hence, the organization should seriously deal with the system testing to discover potential problems and bugs in advance (Al-Mashari et al., 2003).

Limitations and future research

This study has several limitations. First, the sample size is relatively small since it was difficult to find a large number of retailers that have implemented ERP in the Chinese retail industry. A larger sample may further increase the power of the study. Second, the potential for common method variance may exist. We applied Harman's one-factor to test it (Podsakoff and Organ, 1986). The results show that no single factor dominates the covariance of the variables, suggesting that the common method bias is not a major concern in this study. Third, we did not explicitly incorporate some cultural factors into the research model, which should be considered in the future research.

CONCLUSION

Based on the TOE theory, we proposed a research model explaining *post*-implementation success of ERP by taking Chinese retailers as the sample. The *post*-implementation success of ERP indicated by the benefits derived from ERP deployment. We find that ERP implementation quality and organization's readiness significantly influence *post*-implementation success of ERP, and the latter is more influential than the former. This research extends the current studies on ERP from the implementation stage to the *post*-implementation stage, and the findings of this study will help practitioners to better carry out ERP deployment to meet their expectations.

APPENDIX: MEASUREMENT SCALES

Leadership Involvement

LI1: Top management allocated sufficient resources for ERP deployment.

LI2: Top management provided implementation team members with effective incentives.

LI3: Top management strived for support from all over the organization.

Organizational Fit

OF1: Appropriate business process reengineering was conducted.

OF2: Users were systematically trained and educated about ERP.

Effective Project Management

PM1: The ERP implementation team was composed of top-notch personnel from related departments.

PM2: A clear scope of the project and a formal plan were established.

PM3: A competent project manager was selected.

PM4: The progress of ERP deployment was evaluated and disclosed.

System Configuration

SC1: The overall ERP architecture was well configured.

SC2: Rigorous and sufficient testing was conducted.

SC3: The data inputted into the ERP system were accurate and precise.

External Support

ES1: Your organization obtained advice and support from consultants.

ES2: The ERP vendor was involved at the ERP *post*-implementation stage.

ES3: The ERP deployment received recognition and support from upstream suppliers.

Post-Implementation Success

PS1: Your organization obtained substantial benefits.

PS2: Managerial decision efficiency was improved.

PS3: Costs, such as purchasing cost and inventory cost, were reduced.

PS4: Inventory was reduced.

PS5: Customer satisfaction was improved.

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