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## **A study of the selection criteria for enterprise resource planning systems**

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**Abstract:** This study draws on the findings of two cross-sectional surveys of the top 5,000 largest corporations in Taiwan, undertaken in 2003 and 2006. It presents the organisations' criteria for selecting enterprise resource planning (ERP) software package and its supplier. The different selection criteria for ERP software package and its supplier between the two investigative years are discussed. From the results, we also discovered that a number of selection criteria are highly related to a domestic or international ERP package's utilisation and ERP supplier's adoption.

**Keywords:** ERP; enterprise resource planning systems; selection criteria; ERP package's selection; ERP supplier's selection.

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## **1 Introduction**

In order to stay competitive in a dramatically changing business environment, organisations have to enhance their business practices and operational procedures through information technology such as enterprise resource planning (ERP) (e.g. Al-Mashari, 2003; Rao, 2000; Somers and Nelson, 2004; Tsai et al., 2007b), e-commerce (e.g. Aciar et al., 2007; Ahmed et al., 2007; Chuang et al., 2007), e-finance (e.g. Tsai et al., 2006), Knowledge management (e.g. King, 2007), business process reengineering (e.g. Lee et al., 2007), etc. Leem and Kim (2002) pointed out that information technology is an important weapon in the fight to improve and keep an enterprise's competitive edge in an ever-changing business environment. According to Gupta (2000), he considers that the ERP system is an integrated information technology that uses common databases and consistent cross-functional information flow which enables organisations to integrate information from various departments. Moreover, Hong and Kim (2002) found that these demands have prompted more and more firms to shift their information technology strategies from developing in-house information systems to purchase application software, like ERP systems, to generate synergies and enhance operating efficiency. Wallace and Kremzar (2001) also mentioned that operating a business in a rapidly changing and highly competitive environment is the primary purpose of implementing an ERP system. Although implementing an ERP system may be costly and time-consuming,

its benefits are worthwhile. Therefore, ERP systems can be considered as critical tools that can enhance business operations.

Many organisations tend to purchase ERP packages to shorten the ERP implementation cycle time due to a lack of professional expertise and experience within the organisation instead of developing ERP systems in-house. However, not all of the ERP packages in the market can meet all of the requirements and anticipations of every organisation due to organisations' different scales, properties, strategies and goals. Therefore, management teams have to select suitable packages which most closely meet their needs.

Although different hardware platforms, databases, languages and operation systems are provided or recommended by ERP suppliers, a number of ERP software is only compatible with some organisations' databases and operation systems. Thus, before implementing ERP packages, organisations should first conduct a requirements analysis to determine what issues need to be solved and then select the best suitable ERP package. Through careful planning and selection of the right ERP system, an organisation may expect to gain noteworthy advantages.

## **2 Literature review**

According to Jacobs and Weston Jr. (2007), a key to ERP is the way in which users can tailor the application so it is intrinsically easy to use. ERP systems can reduce cycle time, accelerate information distribution, improve financial management, lay the groundwork for e-commerce and make tacit knowledge explicit provided they are properly implemented in a business organisation (Davenport, 2000). In addition, ERP systems are capable of reshaping business structures thanks to their ability to solve the challenges created by portfolios of supposedly disconnected and uncoordinated business applications (Davenport, 1998). Moreover, ERP integrates application programmes for a range of business functions – including sales, accounting and manufacturing – using a common database that serves as the integrating mechanism (Olhager and Selldin, 2003). Thus, ERP incorporates logistic, capital and information via an information technology system so that management teams can obtain firsthand information about a business' operations. Furthermore, ERP can provide suggestions for management teams making decisions and assist them in figuring out an optimal solution. However, ERP system implementation can be both expensive and time-consuming (e.g. Abdinnour-Helm et al., 2003; Kumar et al., 2003). Therefore, choosing a suitable ERP package necessitates considering the degree to which the configured ERP system matches with users' working style and practice and the extent of congruence between what is provided by the ERP system and user task requirements. Further, if the right ERP solution is selected, it can be an excellent decision support tool that will be a gruelling process for companies and provide a competitive advantage.

A large amount of literature concentrating on ERP issues has been published (Esteves and Pastor, 2001). For example, numerous literature regarding ERP implementation have been put forward to illustrate an extensive set of risk factors, management issues and critical success factors for ERP implementation projects (e.g. Al-Mashari et al., 2003; Hong and Kim, 2001; Holland et al., 1999; Nah and Lau, 2001; Nandhakumar et al., 2003; Sumner, 2000; Tsai et al., 2005; Umble et al., 2003; Zhang et al., 2005). Many studies have analysed the different implementation strategies between the different

approaches such as integral planning and big-bang/phased implementation approach and stepwise planning and phased implementation approach (e.g. Holland et al., 1999; Lozinsky and Wahl, 1998; Ross, 1998; Tsai et al., 2007a). Moreover, according to Marius and Ashok (1996), it is hypothesised that packaged software implementation success is positively associated with the degree of software fit with user organisation and the degree of supplier fit with user organisation, respectively. Even there are several empirical studies in ERP field; however, empirical evidence of ERP package and its supplier's selection criteria between two different investigative years for ERP system and its supplier in Taiwan is relatively rare.

According to some researchers, selecting the suitable solution is a critical success factor for ERP system success. The perceived characteristics of the product play a vital role in the final decision to launch using a new product while companies consider purchasing that new product. Among the number of the alternatives, organisations use various criteria for determining the suitable ERP solution. Hecht (1997) presents six major criteria, which are functionality, technical architecture, cost, service and support, ability to execute, and vision, for selection and evaluation process. Edward and Stefan (2001) investigated differences in characteristics of the ERP system selection process between midsize and large organisations. They used 29 different ERP selection criteria and determined only 12 criteria that have strong relationship to organisation size. The criteria for selection of a particular ERP system show different priorities related to organisational size. Organisational flexibility, extra organisational ties with customers and suppliers and internationality are more important for the bigger. Cost and adaptability are more important criteria in selection process for smaller companies. Somers and Nelson (2001) stressed that the choice of the package involves important decisions related to budgets, timeframes, goals and deliverables that will shape the entire projects. Yvonne et al. (2000) did an empirical information research to examine issues of the selection criteria used by European midsize companies for investing ERP systems. They used following six selection criteria: lowest cost, user-friendliness, fit with business procedures, scalability, support and training. Their results show the most important criterion used in selecting an information system is the best fit with the current business procedures. In Kumar et al.'s (2003) research, functionality, system reliability and fit with parent/allied organisation systems are determined as the three most important criteria. Moreover, 17 selection criterion, fit with parent organisation systems, cross-module integration, compatibility with other systems, references of the vendor, vision, functionally, system reliability, consultancy, technical aspect, implementation time, methodology of the software, market position of vendor, ease of customisation, better fit with organisational structure, service and support, cost and domain knowledge of the vendor, are selected as determining the ERP packaged-selecting criteria by Birdogan and Kemal (2005).

Supplier support is an important factor for ERP systems implementation and often includes extended technical assistance, emergency maintenance, updates, service responsiveness, solutions providing, design, customisation support and user training (e.g. Eric et al., 2008; Ramayah et al., 2007; Remus, 2007; Somers and Nelson, 2001; Zhang et al., 2005). Moreover, according to Themistocleous et al. (2001), most companies face technical or other problems during installation, implementation or after implementation period. Integration with existing systems, customisation and security are the most serious problems for the companies. To deal with these problems, companies need support from suppliers both in terms of information technology expertise and

domain knowledge (Rao, 2000). Yvonne et al. (2000) also did an empirical information research to examine issues of the selection criteria used by European midsize companies for choosing an ERP supplier. They use the following eight selection criteria: functionality product, quality product, implementation speed, interface other systems, price, market leadership, corporate image and international orientation. They found companies predominantly value the functionality and quality of the products and services for evaluating ERP suppliers. Verville and Haltingen (2002) determined three distinct types of criteria for evaluation: supplier, functionality and technical. The supplier evaluation criteria in their study include size, financial stability and reputation, etc.

There is an increasing evidence showing that failing to adapt ERP packages to fit requirements, organisations practices and natural culture leads to expensive and late projects and to low user satisfaction (e.g. Krumbholz and Maiden, 2001; Soh et al., 2000). Moreover, Chwen et al. (2004) found that language difference affects the implementation practices in both technical and managerial aspects. Furthermore, they also discovered that while technical problems were relatively easier to resolve, communication barriers resulting from language differences were far more difficult to overcome. Moreover, the results in the study of Tsai et al. (2005) indicated that the ERP package market in Taiwan seems to be dominated by local suppliers. In Taiwan, small and medium-sized enterprises (SMEs) accounted for 97.83% and 97.77% of total enterprises in 2003 and 2006, respectively (sources by: SME administration, Ministry of Economic Affairs). While organisations in Taiwan are much smaller than those in Europe and North America, the budget for implementing ERP packages might be relative limited. Implementing an international ERP package is much more expensive than implementing a domestic one. Therefore, this study infers that not all Taiwanese SMEs could afford to purchase an international ERP package. Thus, we wonder whether other influences of the ERP package's selection criteria would determine to adopt a domestic or international ERP package.

### **3 Methodology**

Questionnaire surveys regarding the implementation of ERP in Taiwan were first conducted in 2003. According to Elisabeth et al. (2003), they had been estimated that the payback period for an ERP system typically ranges from one to three years after implementation; moreover, Mary et al. (2006) also discovered that the first implementation in each of the organisations occurred two to three years after project began. As a result, the questionnaires were distributed out again in three years later, which is 2006. These two surveys examine the ERP implementation experiences of the top 5,000 largest corporations in Taiwan, in order to explore the status of ERP implementation. The questionnaires focus on five areas: the characteristics of ERP implementation, ERP implementation status, motivation and evaluation of pre-implementation process, implementation experience and ERP system configuration, as well as benefits of ERP system and future directions. In this study, we use part of survey data in the questionnaire to examine whether there were any significant differences among the organisations regarding their selection criteria between 2003 and 2006. This section first describes the source of the investigative samples and then states the hypotheses in  $\chi^2$  test for independence.

### *3.1 Sample and data collection*

2003 and 2006 questionnaires were distributed to ranking on the 2001 and 2004 list of top 5000 largest corporations in Taiwan which include the manufacturing industry and service industry. A total of 3957 and 4300 questionnaires were sent to organisations in the years of 2003 and 2006 with usable responses of 657 and 620 received, respectively. After deleting missing responses and unusable ones, the total usable data have been received for response rates of 16.6% in 2003 and 14.4% in 2006. It is worth mentioned that our data collection effort reflects the typically low responses that are commonly seen for information system studies in the field and for our surveys targeting midlevel and senior employees in organisation (Ifinedo, 2006). The response rate is 17% for Bernroider and Koch's (2001) research that also aim to identify the important ERP software selection criteria for Austrian companies and 3.9% for Rao's (2000) research. In this study, only organisations with prior experience of implementing ERP systems were selected as our investigative sample. Therefore, the final investigative samples included 224 out of 657 received questionnaires in 2003 and 249 out of 620 in 2006.

According to a set of evaluation criteria based on the extensive literature review (e.g. Edward and Stefan, 2001; Kumar et al., 2003; Somers and Nelson, 2001; Teltumbde, 2000; Verville and Halingten, 2002; Yvonne et al., 2000) and the consideration of the characteristics and environment of ERP systems, 20 and 9 selection criteria for the ERP package and supplier were identified, respectively. To ensure data validity and reliability of the survey instrument, an iterative process of personal interview with eight knowledgeable individuals (i.e. two information system faculty, two ERP supplier, two ERP consultant and two managerial level user) were conducted to modify the questionnaire before sending it out and their comments also helped us improve its quality. The questionnaires were sent to the ERP project managers and senior project team members of selected companies. In the questionnaire, YES/NO selections were used to see if the selection criteria were taken into account for selecting their ERP package or ERP supplier.

Tables 1 and 2 summarise the basic characteristics of the responding firms in 2003 and 2006, respectively. The sample involved with 19 foreign firms, 17 domestic-foreign joint venture and 188 domestic companies in 2003 in Taiwan and 7 foreign firms, 18 domestic-foreign joint venture and 138 domestic companies in 2006. The sample contained 146 companies (65.18% of 224) with fewer than 300 employees in 2003 and 159 (63.86% of 249) in 2006. A total of 191 companies (85.27% of 224) were with annual revenues below NT\$ 5 billion in 2003 and 205 companies (82.33% of 249) in 2006. The sample also include 207 companies (92.41% of 224) with capital amount less than NT\$ 5000 million in 2003 and 230 companies (92.37% of 249) in 2006. There were 159 companies (62.5% of 224) with more than five years ERP experience in 2003 and 99 companies (39.76% of 249) in 2006. Among these organisations, approximately 174 companies (77.68% of 224) are manufacturers and 50 are members (22.32% of 224) in service industries in 2003; 186 companies (74% of 249) are manufactures and 63 (25.3% of 249) are service industries in 2006. Regarding to the distribution of package software, there are 68 organisations (30.36% of 224) utilise an international package and 154 organisations (68.75% of 224) utilise a domestic package in 2003 and 58 organisations (23.29% of 249) utilise an international package and 190 organisations (76.31% of 249) utilise a domestic one.

**Table 1** Background information on respondents in 2003 ( $N = 224$ )

	<i>Freq.</i>	<i>%</i>		<i>Freq.</i>	<i>%</i>
<i>Employment numbers</i>			<i>Type of company</i>		
Fewer than 100 employees	50	22.32	Foreign	19	8.48
100–300	96	42.86	Domestic-foreign joint venture	17	7.59
More than 300	78	34.82	Domestic	188	83.93
<i>Annual revenue (NT\$ bil.)</i>			<i>Implementation strategies</i>		
\$0.2 or <\$0.5	30	13.39	Integral planning and big-bang approach	87	38.84
\$0.5 to <\$1.0	68	30.36	Integral planning and phased approach	99	44.20
\$1.0 to <\$5.0	93	41.52	Step-by-step planning and phased approach	35	15.63
\$5.0 to <\$10.0	16	7.14	Missing	3	1.34
\$10.0 to <\$30.0	8	3.57			
\$30.0 & up	9	4.02			
<i>Capital amount (NT\$ mil.)</i>			<i>ERP experience (years)</i>		
\$80 or less	19	8.48	Less than 5	23	10.27
\$80 to <\$200	34	15.18	5–6	47	20.98
\$200 to <\$500	65	29.02	6–7	50	22.32
\$500 to <\$1000	47	20.98	7–8	20	8.93
\$1000 to <\$2000	24	10.71	Above 8	42	18.75
\$2000 to <\$5000	18	8.04	Missing	42	18.75
\$5000 to <\$10000	7	3.13			
\$10000 and up	10	4.46			
<i>Industry</i>			<i>Package software</i>		
Manufacturing	174	77.68%	International packages	68	30.36
Services	50	22.32%	Domestic packages	154	68.75
			Missing	2	0.89

**Table 2** Background information on respondents in 2006 ( $N = 249$ )

	<i>Freq.</i>	<i>%</i>		<i>Freq.</i>	<i>%</i>
<i>Employment numbers</i>			<i>Type of company</i>		
Fewer than 100 employees	61	24.50%	Foreign	7	2.81
100 to 300	98	39.36%	Domestic-foreign joint venture	18	7.23
More than 300	90	36.14%	Domestic	138	55.42
			Missing	86	34.54

**Table 2** Background information on respondents in 2006 ( $N = 249$ ) (continued)

	<i>Freq.</i>	<i>%</i>		<i>Freq.</i>	<i>%</i>
<i>Annual revenue</i> (NT\$ bil.)			<i>Implementation</i> <i>strategies</i>		
\$0.2 or <\$0.5	38	15.26	Integral planning and big-bang approach	92	36.95
\$0.5 to <\$1.0	69	27.71	Integral planning and phased approach	125	50.20
\$1.0 to <\$5.0	98	39.36	Step-by-step planning and phased approach	29	11.65
\$5.0 to <\$10.0	22	8.84	Missing	3	1.20
\$10.0 to <\$30.0	14	5.62			
\$30.0 and up	8	3.21			
<i>Capital amount</i> (NT\$ mil.)			<i>ERP experience (years)</i>		
\$80 or less	21	8.43	Less than 5	96	38.55
\$80 to <\$200	50	20.08	5–6	25	10.04
\$200 to <\$500	68	27.31	6–7	25	10.04
\$500 to <\$1000	37	14.86	7–8	29	11.65
\$1000 to <\$2000	36	14.46	Above 8	20	8.03
\$2000 to <\$5000	18	7.23	Missing	54	21.69
\$5000 to <\$10000	10	4.02			
\$10000 and up	7	2.81			
Missing	2	0.80			
<i>Industry</i>			<i>Package software</i>		
Manufacturing	186	74.70	International packages	58	23.29
Services	63	25.30	Domestic packages	190	76.31
			Missing	1	0.40

### 3.2 The hypotheses

Percentage and ranking were calculated to study the data of the responses.  $\chi^2$  test was also used to test the independence of responses among the ERP package/supplier's selection criteria and among the utilisation preference of a domestic or international ERP package.

There are 29 selection criteria, which are 20 ERP package's selection criteria and 9 ERP package supplier's selection criteria, in determining whether to utilise a domestic or international ERP package in the questionnaire. The null hypothesis states that a selection criterion does not affect the determination of whether to utilise a domestic or international ERP package. The alternative hypothesis is that the selection criterion does affect the determination of whether to utilise a domestic or international ERP package.

$H_0$ . A selection criterion does not affect the determination of whether to utilise a domestic or international ERP package.

$H_1$ . A selection criterion does affect the determination of whether to utilise a domestic or international ERP package.

Reject  $H_0$  if the  $p$ -value is significant. This means the selection criterion does affect the determination of whether to utilise a domestic or international ERP package.



## 4 Data analysis and findings

This section focuses on two main parts. First, the ERP packages and their suppliers' selection criteria are compared in 2003 and 2006. Second, the influences of ERP packages and their suppliers' selection criteria on determining whether to utilise a domestic or international ERP package are examined by  $\chi^2$  test of independence.

### 4.1 Survey evidence – analysis of percentage

The survey evidence for the percentage and the ranking of an ERP package selection criteria in 2003 and 2006 are listed in Table 1. As can be seen, there is a big difference between these two investigative years. In the year of 2003, the top three selection criteria of 'the compatibility between the system and the business process', 'the integrity of the module framework' and 'total cost of ownership' are chosen by most of the responding organisations with 52.2%, 51.8% and 50.0%, respectively. However, in the year of 2006, these three criteria are ranked behind 'ease of use and maintenance' with 57 % and 'real-time online inquiries and reporting functions' criteria with 55.8%. A possible reason for this is that in the year of 2006, organisations put more emphasis on the usefulness of ERP packages in the pre-implementation stage. Thus, selecting the ERP packages that best fit the organisation's information needs and processes is crucial for ensuring minimal customisation as well as successful implementation and use (Janson and Subramanian, 1996). The emergence of two criteria is also identified as the most important criteria in Kumar et al.'s (2003) and Yvonne et al.'s (2000) research. In Birdogan and Kemal's (2005) study, the second and the third important selection criteria, integration and compatibility, are ranking the fourth and the third for the Taiwanese companies. Table 3 also displays that the top seven selection criteria in both of the investigative years are the same except for a few minor differences in their rankings. Furthermore, their percentages are all over 40%.

Figure 1 shows clearly that there are big differences in the following two selection criteria

- 1 with an explicit guidance for the implementation process and aid instruments
- 2 consultant's suggestions.

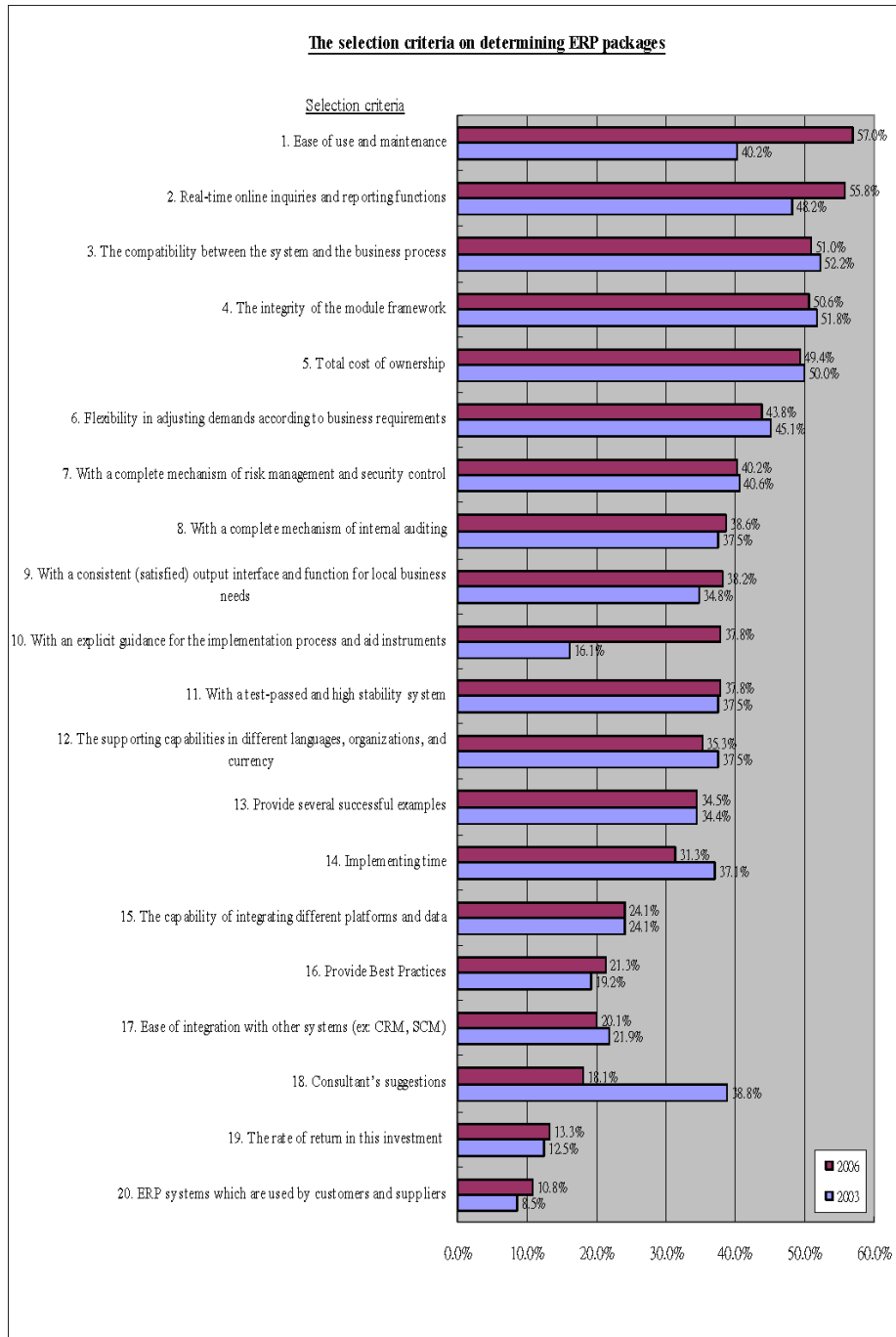
The percentage for 'with an explicit guidance for the implementation process and aid instruments', which is the eleventh selection criteria for the Turkish companies in Birdogan and Kemal (2005) research, is 16.1% (ranking 18) in 2003 but it increases to 37.8% (ranking 10) in 2006. Thus, this percentage increased by 21.7% and climbed eight rankings. This implies that in order to ensure that Taiwanese organisations can implement ERP systems successfully within their time schedules and budgets, they attach more importance to whether ERP packages offer explicit guidance for the implementation process and aid instruments after three years' experience gain. As Birdogan and Kemal (2005) pointed out, ERP systems are projects that cause massive change in companies; therefore, the project should include a clear guideline. The provided guidelines should be effective and should not include unnecessary activities for the companies. In every stage of the guideline, it should be determined that what activities will be carried out, how, when and with which resources. For example, accelerated SAP (ASAP) is an implementation guideline provided by SAP with five implementation phase:

**Table 3** Enterprise resource planning package selection criteria

<i>The selection criteria on determining ERP packages</i>	<i>Year 2003</i>			<i>Year 2006</i>		
	<i>No. of respondents</i>	<i>%</i>	<i>Ranking</i>	<i>No. of respondents</i>	<i>%</i>	<i>Ranking</i>
1 Ease of use and maintenance	90	40.2	7	142	57.0	1
2 Real-time online inquiries and reporting functions	108	48.2	4	139	55.8	2
3 The compatibility between the system and the business process	117	52.2	1	127	51.0	3
4 The integrity of the module framework	116	51.8	2	126	50.6	4
5 Total cost of ownership	112	50.0	3	123	49.4	5
6 Flexibility in adjusting demands according to business requirements	101	45.1	5	109	43.8	6
7 With a complete mechanism of risk management and security control	91	40.6	6	100	40.2	7
8 With a complete mechanism of internal auditing	84	37.5	9	96	38.6	8
9 With a consistent (satisfied) output interface and function for local business needs	78	34.8	13	95	38.2	9
10 With an explicit guidance for the implementation process and aid instruments	36	16.1	18	94	37.8	10
11 With a test-passed and high stability system	84	37.5	10	94	37.8	11
12 The supporting capabilities in different languages, organisations and currency	84	37.5	11	88	35.3	12
13 Provide several successful examples	77	34.4	14	86	34.5	13
14 Implementing time	83	37.1	12	78	31.3	14
15 The capability of integrating different platforms and data	54	24.1	15	60	24.1	15
16 Provide best practices	43	19.2	17	53	21.3	16
17 Ease of integration with other systems (e.g. CRM, SCM)	49	21.9	16	50	20.1	17
18 Consultant's suggestions	87	38.8	8	45	18.1	18
19 The rate of return in this investment	28	12.5	19	33	13.3	19
20 ERP systems which are used by customers and suppliers	19	8.5	20	27	10.8	20
Total respondents	224	100.0		249	100.0	

*Note:* The respondents are organisations that have experience implementing ERP packages; there are 224 responding firms in 2003 and 249 responding firms in 2006.

**Figure 1** Enterprise resource planning package selection criteria (see online version for colours)



*Note:* The respondents are organisations that have experience implementing ERP packages; there are 224 responding firms in 2003 and 249 responding firms in 2006.

- 1 project preparation phase
- 2 business blueprint phase
- 3 realisation phase
- 4 final preparation phase
- 5 go-live and support phase.

Besides, AIM is an implementation guideline provided by Oracle with six implementation stages:

- 1 definition
- 2 operations analysis
- 3 solution design
- 4 build
- 5 transition
- 6 production.

The providing guidelines by vendors who offer explicit guidance and aid instruments for implementation processes can reduce implementation time and unexpected problems.

The percentage for 'consultant's suggestions', which is the eighth important selection criteria for the Turkish companies in Birdogan and Kemal (2005) research, is 38.8% (ranking 8) in 2003, but it decreases to 18.1% (ranking 18) in 2006. The percentage decreases by 20.7% as well as descends 10 rankings. According to Bhatti (2006), due to the complexity of implementing an ERP system, it requires the use of either internal or external experts who are knowledgeable about the installation and software. Many companies prefer or must have external consultants to perform ERP installation. The 2003 survey results support Bhatti's findings. Moreover, consultants are often involved in requirements analysis, determining the right solution and managing the implementation. If the company is not experienced in software implementation and employees lack computer literacy, consultant factor gains important (Birdogan and Kemal (2005). However, in 2006, Taiwanese organisations might have increased their knowledge after gaining three years of experience from other industries so that consultant's suggestions are perceived as less value in this 2006 survey. In addition, as Somers and Nelson (2004) revealed in their research on ERP implementation, consultants may be involved in different stages of the ERP implementation. Thus, many companies tend to hire or foster their own experts to handle their ERP implementation planning in order to make it more efficient.

Table 4 summarises the percentage and the ranking of selection criteria on ERP suppliers in 2003 and 2006. All of the results, except for supplier's 'market position', 'supplier's goodwill' and 'training support by suppliers' show different rankings between 2003 survey and 2006 survey, there are no other changes in the rest of the selection criteria. Suppliers' 'technique-support and experience' and 'support for maintaining and updating after go-live' are the two most important factors that organisations considered in both years. The results are the same as Bernroider and Koch (2001) research which pointed out good support is the most important criterion for the large firms. Moreover,

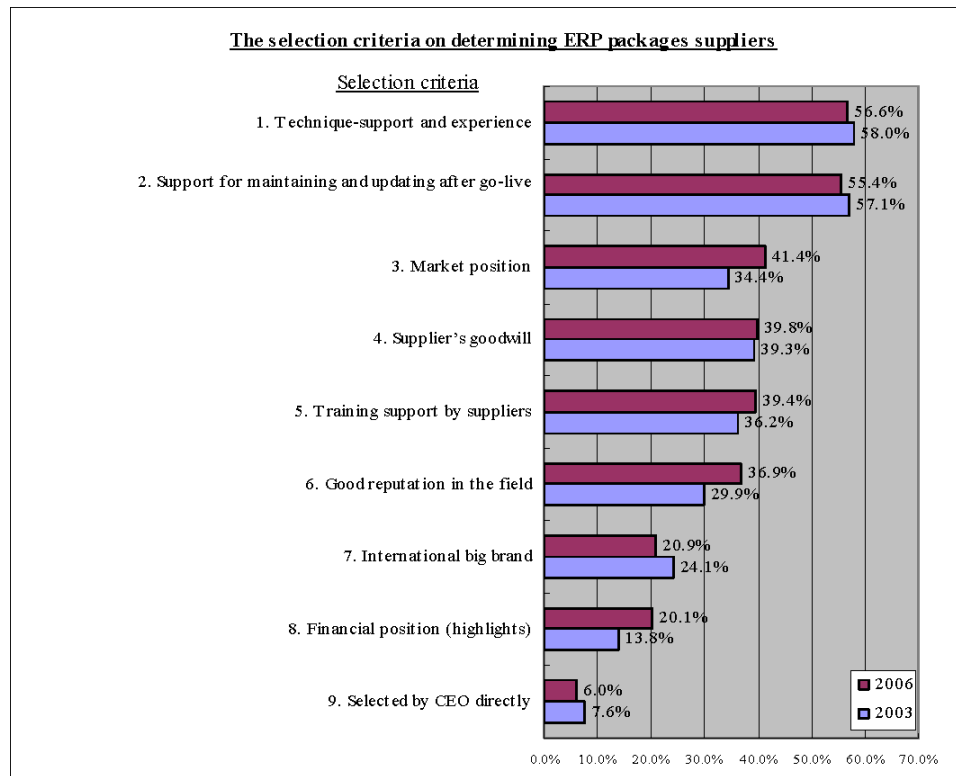
because installation and ongoing costs can reach seven to ten times the initial software cost, the service and support associated with the application becomes crucial to the success of the partnership between end user and application vendor (Hecht, 1997). This also highlights the reason why organisations focus on the top two selection criteria. As Shikarpur (1997) mentioned, users need to check the currency of information technology trends in the ERP product and examine if the vendor is committed to incorporating the latest trends in information technology in the product. Furthermore, in Rao (2000) research, it is important that the software developer or supplier knows the industry and is willing to implement the software for the industry. If the industry is a manufacturing enterprise, company should procure the software from the supplier that has experience in manufacturing industry and should make sure that the suppliers undertake to up-grade the products to make best use of technologies that are likely to become available in the future. These do explain the reason why the two selection criteria remain top 1 and 2 selection criteria in both years.

The third and the fourth important selection criteria on determining an ERP package supplier are supplier's 'market position' and 'supplier's goodwill'. Especially for whether the ERP package supplier is in good 'market position', the percentage rises from 34.4% in 2003 to 41.4% in 2006, which is an increase of 7%. The result is similar with Bernroider and Koch (2001) research, market position of supplier is a very important criterion for large companies. This big difference can be found clearly in Figure 2. The consequences also imply that in the beginning of implementing ERP packages in 2003, organisations had little experience in the industry so that they lay high stress on supplier's market position and service infrastructure when selecting their ERP packages (Kumar et al., 2003). Moreover, the world's leading ERP suppliers have implemented the best global practices in their ERP products.

**Table 4** Enterprise resource planning supplier selection criteria

<i>The selection criteria on determining an ERP package supplier</i>	<i>Year 2003</i>			<i>Year 2006</i>		
	<i>No. of respondents</i>	<i>%</i>	<i>Ranking</i>	<i>No. of respondents</i>	<i>%</i>	<i>Ranking</i>
1 Technique-support and experience	130	58	1	141	56.6	1
2 Support for maintaining and updating after go-live	128	57.1	2	138	55.4	2
3 Market position	77	34.4	5	103	41.4	3
4 Supplier's goodwill	88	39.3	3	99	39.8	4
5 Training support by suppliers	81	36.2	4	98	39.4	5
6 Good reputation in the field	67	29.9	6	92	36.9	6
7 International big brand	54	24.1	7	52	20.9	7
8 Financial position (highlights)	31	13.8	8	50	20.1	8
9 Selected by CEO directly	17	7.6	9	15	6.0	9
Total respondents	224	100		249	100.0	

*Note:* The respondents are organisations that have experience implementing ERP packages; there are 224 responding firms in 2003 and 249 responding firms in 2006.

**Figure 2** Enterprise resource planning supplier selection criteria (see online version for colours)

*Note:* The respondents are organisations that have experience implementing ERP packages; there are 224 responding firms in 2003 and 249 responding firms in 2006.

For this reason, the organisations can look at the ERP product as a process advisor (Shikarpur, 1997). Nevertheless, three years later, in 2006, more organisations might have experience successfully implementing ERP packages and they had much ERP knowledge so that new implementing organisations might have more opportunities to learn from other businesses as well as from their own experience. As a result, organisations could consider further when they are selecting ERP packages. 'Training support' is ranking the fourth in 2003 and the fifth in 2006. As Somers and Nelson (2004) mentioned, in the ERP implementation process, many projects fail in the end due to a lack of proper training. Many organisations consider users' training and education to be an important factor of successfully implementing ERP. The main reason for having education and training programmes for ERP implementation is to make the user comfortable with the system and increase the expertise and knowledge level of the employees. ERP-related concepts, features of the ERP system and hands-on training are all important dimensions of a training programme for ERP implementation. 'International big brand' is ranking the seventh in both 2003 and 2006. The result is similar with Bernroider and Koch (2001) research that internationality of the software and supplier needs are given less important. In addition, from Figure 2, we can find the percentages of suppliers' 'good reputation in the field' and 'financial position' also climb from 29.9% to

36.9% and 13.8% to 20.1%, respectively. According to Verville and Haltingen (2002), in the supplier evaluation process, criteria such as supplier strength and/or reputation, financial stability are considered. These imply that most organisations purchased their ERP packages by considering whether they can obtain more warranty and assurance from their suppliers.

#### *4.2 Survey evidence – analysis by $\chi^2$ test of independence*

Two main themes are examined in this section. First, the influences of ERP package's selection criteria on determining whether to utilise a domestic or international ERP package are revealed. Second, the influences of an ERP package supplier's selection criteria on determining whether to utilise a domestic or international ERP package are inspected. In this section,  $\chi^2$  test of independence is adopted to analyse the respondents' information.

##### *4.2.1 Influences of an enterprise resource planning package's selection criteria on determining whether to utilise a domestic or international enterprise resource planning package*

Influences of an ERP package's selection criteria on determining whether to utilise a domestic or international ERP package in year 2003 and year 2006 are illustrated in Tables 5 and 6, respectively. According to the data analysis in Table 5, there are nine selection criteria that have significant influences in 2003:

- 1 with a complete mechanism of risk management and security control
- 2 ease of integration with other systems
- 3 with a consistent (satisfied) output interface and function for local business needs
- 4 the compatibility between the system and the business process
- 5 the capability of integrating different platforms and data
- 6 the supporting capabilities in different languages, organisations and currency
- 7 ease of use and maintenance
- 8 implementing time
- 9 with an explicit guidance for the implementation process and aid instruments.

From Table 6, we can found that the significant influences increase to 11 items in 2006. Only five significant influences, which are 'ease of integration with other systems', 'the capability of integrating different platforms and data', 'the supporting capabilities in different languages, organisations and currency', 'ease of use and maintenance' and 'with an explicit guidance for the implementation process and aid instruments', remain the same as 2003. The rest six emergence significant selection criterion are 'with a complete mechanism of internal auditing', 'the integrity of the module framework', 'provide best practices', 'with a test-passed high stability system', 'consultant's suggestions' and 'ERP systems which are used by customers and suppliers'. As a result, the significant selection criteria change a lot after three years time period. This is also an interesting issue that we can do further research.

**Table 5** Influences of an enterprise resource planning package's selection criteria on determining whether to utilise a domestic or international enterprise resource planning package in 2003

<i>Year 2003</i>	<i>p-value<sup>a</sup></i>	<i>Consider or not</i>	<i>International packages (%)</i>	<i>Domestic packages (%)</i>
1 Total cost of ownership	0.172	Yes	44.19	55.81
		No	34.09	65.91
2 Flexibility in adjusting demands according to business requirements	0.868	Yes	38.36	61.64
		No	39.60	60.40
3 With a complete mechanism of risk management and security control	0.030**	Yes	49.25	50.75
		No	32.71	67.29
4 With a complete mechanism of internal auditing	0.309	Yes	34.33	65.67
		No	42.06	57.94
5 Real-time online inquiries and reporting functions	0.513	Yes	36.36	63.64
		No	41.24	58.76
6 Ease of integration with other systems (CRM, SCM)	0.001***	Yes	62.16	37.84
		No	32.85	67.15
7 With a consistent (satisfied) output interface and function for local business needs	0.050**	Yes	28.57	71.43
		No	43.07	55.93
8 The integrity of the module framework	0.168	Yes	43.96	56.04
		No	33.73	66.27
9 The compatibility between the system and the business process	0.045**	Yes	31.33	68.67
		No	46.15	53.85
10 The rate of return in this investment	0.455	Yes	31.82	68.18
		No	40.13	59.87
11 Provide best practices	0.146	Yes	50.00	50.00
		No	36.43	63.57
12 The capability of integrating different platforms and data	0.015**	Yes	54.55	45.45
		No	33.85	66.15
13 The supporting capabilities in different languages, organisations and currency	0.000***	Yes	58.21	41.79
		No	27.10	72.90
14 With a test-passed high stability system	0.199	Yes	45.31	54.69
		No	35.45	64.55
15 Ease of use and maintenance	0.000***	Yes	21.54	78.46
		No	49.54	50.46
16 Implementing time	0.057*	Yes	29.51	70.49
		No	44.25	55.75
17 Consultant's suggestions	0.690	Yes	35.71	64.29
		No	39.73	60.27



**Table 5** Influences of an enterprise resource planning package's selection criteria on determining whether to utilise a domestic or international enterprise resource planning package in 2003 (continued)

<i>Year 2003</i>	<i>p-value<sup>a</sup></i>	<i>Consider or not</i>	<i>International packages (%)</i>	<i>Domestic packages (%)</i>
18 Provide several successful examples	0.583	Yes	36.21	63.79
		No	40.52	59.48
19 ERP systems which are used by customers and suppliers	0.523	Yes	30.77	69.23
		No	39.75	60.25
20 With an explicit guidance for the implementation process and aid instruments	0.013**	Yes	50.75	49.25
		No	31.78	68.22

*Note:* The respondents are organisations that have experience implementing ERP packages; <sup>a</sup> $p < 10%$ ; \*\* $p < 5%$ ; \*\*\* $p < 1%$ ; number of respondents: 224.

**Table 6** Influences of an enterprise resource planning package's selection criteria on determining whether to utilise domestic or international enterprise resource planning package in 2006

<i>Year 2006</i>	<i>p-value<sup>a</sup></i>	<i>Consider or not</i>	<i>International packages (%)</i>	<i>Domestic packages (%)</i>
1 Total cost of ownership	0.387	Yes	26.97	73.03
		No	32.69	67.31
2 Flexibility in adjusting demands according to business requirements	0.383	Yes	33.33	66.67
		No	27.52	72.48
3 With a complete mechanism of risk management and security control	0.322	Yes	34.25	65.75
		No	27.50	72.50
4 With a complete mechanism of internal auditing	0.067*	Yes	22.22	77.78
		No	34.71	65.29
5 Real-time online inquiries and reporting functions	0.369	Yes	32.71	67.29
		No	26.74	73.26
6 Ease of integration with other systems (CRM, SCM)	0.094*	Yes	41.03	58.97
		No	27.27	72.73
7 With a consistent (satisfied) output interface and function for local business needs	0.132	Yes	23.61	76.39
		No	33.88	66.12
8 The integrity of the module framework	0.000***	Yes	42.72	57.28
		No	15.56	84.44
9 The compatibility between the system and the business process	0.423	Yes	32.65	67.35
		No	27.37	72.63
10 The rate of return in this investment	0.959	Yes	29.63	70.37
		No	30.12	69.88

**Table 6** Influences of an enterprise resource planning package's selection criteria on determining whether to utilise domestic or international enterprise resource planning package in 2006 (continued)

<i>Year 2006</i>	<i>p-value<sup>a</sup></i>	<i>Consider or not</i>	<i>International packages (%)</i>	<i>Domestic packages (%)</i>
11 Provide best practices	0.000***	Yes	60.00	40.00
		No	20.95	79.05
12 The capability of integrating different platforms and data	0.075*	Yes	40.43	59.57
		No	26.7	73.29
13 The supporting capabilities in different languages, organisations, and currency	0.000***	Yes	50.00	50.00
		No	19.69	80.31
14 With a test-passed high stability system	0.005***	Yes	37.97	62.03
		No	22.69	77.31
15 Ease of use and maintain	0.014**	Yes	22.94	77.06
		No	39.29	60.71
16 Implementing time	0.352	Yes	25.42	74.58
		No	32.09	67.91
17 Consultant's suggestions	0.013**	Yes	47.22	52.78
		No	26.11	73.89
18 Provide several successful examples	0.162	Yes	36.23	63.77
		No	26.61	73.39
19 ERP systems which are used by customers and suppliers	0.048**	Yes	47.83	52.17
		No	27.65	72.35
20 With an explicit guidance for the implementation process and aid instruments	0.046**	Yes	37.97	62.03
		No	24.56	75.44

*Note:* The respondents are organisations that have experience implementing ERP packages; <sup>a</sup> $p < 10\%$ ; \*\* $p < 5\%$ ; \*\*\* $p < 1\%$ ; number of respondents: 249.

From Tables 5 and 6, it also can be seen that different selection criteria affect whether a domestic or international ERP package is chosen. It can be found from Table 5, in the year of 2003, organisations, that considered 'ease of integration with other systems', 'the capability of integrating different platforms and data', 'the supporting capabilities in different languages, organisations and currency' in the ERP package selection, tended to utilise an international ERP package; however, organisations, that did not consider these criteria, tended to utilise a domestic one. This implies that an international package might have better integration and functionality than domestic one. Besides, organisations, that considered 'ease of use and maintain' in the ERP package selection, tended to utilise a domestic ERP package, but for those, that did not consider these criteria in the ERP package selection, showed no difference in the selection of an international or domestic ERP package. This connotes that a domestic package might be easier to be used and maintained than an international one so that organisations that select this criterion go for choosing to implement a domestic ERP package.

Influences of an ERP package's selection criteria on determining whether to utilise a domestic or international ERP package in 2006 are displayed in Table 6. There are four significant selection criteria at the 1% level: 'the integrity of the module framework', 'provide best practice', 'the supporting capabilities in different languages, organisations and currency', and 'with a test-passed high stability system'. Except for organisations, that considered 'provide best practice' in the ERP package selection, tended to utilise an international ERP package and organisation, that considered 'the supporting capabilities in different languages, organisations and currency' in the ERP package selection, showed no difference in the selection of an international or domestic ERP package. Organisations, that considered the rest two selection criteria 'the integrity of the module framework' and 'with a test-passed high stability system' in the ERP package selection, tended to utilise a domestic ERP package. On the other hand, organisations that did not consider these four criteria obviously tended to adopt a domestic ERP package. The results are similar with Chwen et al. (2004), they pointed out that many implementation decisions, including the selection of software, were largely decentralised to local units. Our results imply that more Taiwanese companies use the domestic ERP software packages than the international ones.

#### *4.2.2 Influences of an enterprise resource planning package supplier's selection criteria on determining whether to utilise a domestic or international enterprise resource planning package*

Influences of an ERP package supplier's selection criteria on determining whether to utilise a domestic or international ERP package in 2003 and 2006 are presented in Tables 7 and 8, respectively. In the year of 2003, 'market position' and 'international big brand' exert significant difference between international packages or domestic packages chosen. Except for 'market position' and 'international big brand' that have significant influences on whether to utilise a domestic or international ERP package in both years, there are other three significant influences such as 'supplier's goodwill', 'training support by suppliers' and 'support for maintaining and updating after go-live' show significant influence in 2006.

From Tables 7 and 8, it also can be seen that different ERP package supplier's selection criteria have different effects on determining whether to utilise a domestic or international ERP package. For example, in 2003, organisations, that considered 'market position' and 'international big brand' in the ERP package selection, tended to utilise an international ERP package; however, for those, that did not consider these criteria in the ERP package selection, tended to utilise a domestic ERP package. In 2006, organisations, that considered 'international big brand' in the ERP package selection, had the same result as the survey in 2003. Nevertheless, as for 'market position', organisation, that considered or not considered this criterion in the ERP package selection, tended to utilise a domestic ERP package. The investigative data are much the same as Holsapple et al.'s (2005) research that the ERP packages supplier in Taiwan seems to be dominated by domestic suppliers.

**Table 7** The analysis of the influence of an enterprise resource planning package supplier's selection criteria on determining whether to utilise a domestic or international enterprise resource planning package in 2003

<i>Year 2003</i>	<i>p-value<sup>a</sup></i>	<i>Consider or not</i>	<i>International packages (%)</i>	<i>Domestic packages (%)</i>
1 Market position	0.000***	Yes	55.88	44.12
		No	28.30	71.70
2 Supplier's goodwill	0.868	Yes	38.36	61.64
		No	39.60	60.40
3 International big brand	0.000***	Yes	87.50	12.50
		No	20.63	79.37
4 Good reputation in the field	0.654	Yes	36.54	63.46
		No	40.16	59.84
5 Selected by CEO directly	0.219	Yes	23.08	76.92
		No	40.37	59.63
6 Training support by suppliers	0.225	Yes	33.33	66.67
		No	42.59	57.41
7 Financial position (highlights)	0.392	Yes	47.62	52.38
		No	37.91	62.09
8 Technique-support and experience	0.551	Yes	37.11	62.89
		No	41.56	58.44
9 Support for maintaining and updating after going live (go-live)	0.684	Yes	37.76	62.24
		No	40.79	59.21

Note: <sup>a</sup> $p < 10\%$ ; <sup>\*\*</sup> $p < 5\%$ ; <sup>\*\*\*</sup> $p < 1\%$ ; number of respondents: 224.

**Table 8** The analysis of the influence of an enterprise resource planning package supplier's selection criteria on determining whether to utilise a domestic or international enterprise resource planning package in 2006

<i>Year 2006</i>	<i>p-value<sup>a</sup></i>	<i>Consider or not</i>	<i>International packages (%)</i>	<i>Domestic packages (%)</i>
1 Market position	0.000***	Yes	43.75	56.25
		No	16.49	83.51
2 Supplier's goodwill	0.063*	Yes	33.33	66.67
		No	27.52	72.48
3 International big brand	0.000***	Yes	82.22	17.78
		No	14.19	85.81
4 Good reputation in the field	0.188	Yes	35.62	64.38
		No	26.67	73.33
5 Selected by CEO directly	0.638	Yes	36.36	63.64
		No	29.67	70.33

**Table 8** The analysis of the influence of an enterprise resource planning package supplier's selection criteria on determining whether to utilise a domestic or international enterprise resource planning package in 2006 (continued)

<i>Year 2006</i>	<i>p-value<sup>a</sup></i>	<i>Consider or not</i>	<i>International packages (%)</i>	<i>Domestic packages (%)</i>
6 Training support by suppliers	0.025**	Yes	20.55	79.45
		No	35.83	64.17
7 Financial position (highlights)	0.844	Yes	31.43	68.57
		No	29.75	70.25
8 Technique-support and experience	0.421	Yes	27.62	72.38
		No	32.95	67.05
9 Support for maintaining and updating after going live (go-live)	0.033**	Yes	31.43	68.57
		No	28.41	71.59

Note: <sup>a</sup> $p < 10\%$ ; <sup>\*\*</sup> $p < 5\%$ ; <sup>\*\*\*</sup> $p < 1\%$ ; number of respondents: 249.

## 5 Conclusions

ERP is, in principle, applicable to all industries, although there is recognition that it might be costly to implement; however, in general, it brings huge benefits after organisations implement it. A major implication of this point lies in the difference in selection criteria for determining whether to utilise a domestic or international ERP package and supplier. Empirical evidence exists to suggest that organisations have tended to think highly of the compatibility between the system and the business process, the integrity of the module framework and the total cost of implementation. Besides, organisations also value whether ERP packages are easy to use and maintain as well as whether ERP packages allow for real-time online inquiries and reporting functions. Moreover, organisations focus more on whether ERP packages provide an explicit guidance for the implementation process and aid instruments. Because ERP systems are projects that might cause massive change in companies, the project must include a clear guideline which should be effective and should not include unnecessary activities for the companies (Birdogan and Kemal, 2005). However, organisations seem not to value consultants' suggestions as much as they used to in 2003. According to Tsai et al. (2005), during the post-implementation stage, ERP software suppliers or consultants should play important roles. Moreover, Piturro (1999) also pointed out that companies obtain an advantage from consultants' experience, comprehensive knowledge of certain modules and experience with the software applications. Nevertheless, customisation should only be requested when essential (Somers and Nelson, 2001). Within three years, organisations that have not yet implemented ERP systems might have many opportunities to learn from and share experiences with those who have already implemented them. Thus, this may explain why organisations that select consultants' suggestions as important decreases in 2006.

As for the selection criteria of ERP suppliers, suppliers should provide technique-support and experience as well as support for maintaining and up-grading after going live (go-live) are the two main important factors in both investigative years. As Welti (1999)

pointed out, the success of the ERP project depends on the capabilities of the suppliers because they have in-depth knowledge of the software.

The results from this research paper show that there are four selection criteria 'the integrity of the module framework', 'provide best practices', 'the supporting capabilities in different languages, organisation and currency', and 'with a test-passed high stability system' closely related to a domestic or international ERP package's utilisation. And there are two selection criteria 'market position' and 'international big brand' expressing highly connection with a domestic or international ERP package supplier's adoption.

This study investigated critical selection criteria for ERP packages and suppliers in ERP implementation and demonstrated how the results could be applied to understand the ERP implementation experience of Taiwanese organisations. By analysing these investigative results, this study does not contradict other ERP project research, but rather provides a different view for understanding such research.

This research also provided useful reference for ERP suppliers and vendors as well as those who plan to implement ERP systems into their organisations.

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