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The Factors of ERP Customization from Consulting Company's Perspective

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ABSTRACT: *Enterprise Resource Planning (ERP) has become an essential information tool for modern enterprises. Enterprises should adjust existing processes to meet the ERP framework or keep them and customize the ERP when implementing it. The most practical way to implement it is partial ERP customization. This study selected the biggest ERP consulting company as the example for the case study, followed by a questionnaire survey to explore the decision factors of the consulting company for ERP customization.*

The analysis of results of the questionnaire shows consultants consider cost and time while they assess the possibility of ERP customization and they value more the necessity and useful results of it in a long run than rise in benefit in a short run. The situation analysis reveals consultants take a positive attitude to some particular industries like electronic, specific industries for ERP customization; relatively, a negative attitude to some non-representative traditional industries. It also suggests experienced consultants focus more on creating value in a long term considering ERP customization. Therefore, there is significant differentiation among attitudes of consultants from different seniorities for ERP customization.

The main contribution of this study is that in the future, consultants may refer to the decision factors for ERP customization in it and design a customization-related check form into which these factors they stress are translated to provide them with a quick reference index for customization assessment. This index may improve the quality of the assessment of consultants on consistency and preciseness.

KEYWORDS: *Enterprise Resource Planning System, ERP, Consultant, Customization, Code.*

1. Introduction

Enterprise Resource Planning (ERP) has become an essential information tool for modern enterprises. It was developed from data processing (DP), management information system (MIS), material requirements planning (MRPI), and manufacturing resource planning system (MRPII) into ERP in the 1990s. From the beginning, it was solely a system for processing data and then developed into a system for planning

materials and production and eventually a multifunctional system with the integration of internal resources for sales, production and finance. ERP improves operational efficiency by integrating business processes and provides better access to integrated data across the entire enterprise (Davenport, 2000). While ERP integrates the processes by which businesses operate and saves time and expense, the failure rate of ERP implementation ranges from 40% to 60% (Liang et al., 2007).

The high failure rate of ERP implementation might be ascribe to the different interests between the businesses that aim to provide the optimal solutions for business problem and ERP consulting companies that prefer general solutions (Hong & Kim, 2002; Rajagopal, 2002). Packaged ERP systems are the dominant system used in many organizations (Mabert, Soni & Venkataramanan, 2000). However, packaged ERP system often does not meet the existing information processing requirements and demands. (Hong & Kim, 2002; Mabert, Soni & Venkataramanan, 2001). Thus, it is expected the implementation of ERP systems are associated with a problem of misfit such as the gaps between the functionality provided by the packaged ERP system and that needed in the business (Soh, Kien & Tay-Yap, 2000). For reasons of misalignment and strategic alignment, customizations of enterprise systems are necessary. One estimate is that 20% of the processes in an organization cannot be modeled in an ERP system without customization (Scott & Kaindl, 2000). Software modification and customizations are needed for the ERP system to meet the needs of the organization

In most ERP system implementations, some degree of system customization is needed. However, customizations that involve extensive additions to the ERP system or modifications of ERP system code may compromise the success because too much customization increase costs and limits maintainability (Rothenberger & Strite, 2009). Several prior studies discuss the issue of ERP customization and most of them are from the viewpoint of the business (Chang, 2002). Only few papers study ERP customization from the viewpoint of consultants. In typical ERP system practice, the percentage of the content meeting the need of enterprises is about 70% and the remaining 30% needs the guidance from experienced and professional consultants (Bingi, Sharma & Godla, 1999).

According to recent industry analysis, customizations still play an important role in ES implementations and can be a significant cost factor (Genovese, 2007; Ni, 2008; Zastrocky & Harris, 2008). The consulting company is responsible for considering whether the enterprise needs customization throughout the process of ERP implementation. There are certain steps to implement the ERP system: understanding and collecting, system planning, system assessment, implementation preparation, operation analysis and process design, education and training, operation simulation, production and verification and improvement (Liao, 1998). The step of operation analysis aims at

analyzing the differences between practical processes and the system. The consulting company convinces enterprises to reduce costs by decreasing the customization. If customization is a must, what are the factors affecting the consulting company to agree on customization?

The issues this study aims to discuss are as follows: (1) Effects of consultants on the decision for ERP customization and what role they play; (2) Discuss the influence of customization on enterprises from the viewpoint of a consulting company; (3) The factors why a consulting company accepts the task of customization. Based on three issues above, this paper is going to study the decision factors for ERP customization from the viewpoint of a consulting company with exploratory study. An in-depth case study was conducted on a large-scale software company in Taiwan to find out the issues. This paper provides a reference for a consulting company on making decision during helping enterprises to customize their ERP system.

The purpose of this paper is to understand how the consulting company makes decisions and reaches an agreement with its clients when it is asked to customize the system during implementation with a case study of a large software company. We hope the consulting company will build up a customization mechanism which simplifies the project staff to earn the highest profits for the company and earn the trust of clients to create a win-win situation. The paper is divided into five sections: the first section: introduction; the second section: literature review; the third section: research designs and methodology; the fourth section: analysis of empirical study; the fifth section: conclusions.

2. Literature review

2.1 Enterprise Resource Planning

Information technology grew rapidly in the 90s, which has contributed to the changes in enterprises to adapt the global competition. Enterprises started to implement the ERP system to catch up with the rapidly changing market and the growing price competition. American Production and Inventory Control Society (APICS) defines ERP: "ERP system is an accounting-oriented information system for identifying and planning the enterprise wide resources needed to take, make, ship and account for customer orders to expand its overall performance and reduce its costs (APICS The Association for Operations Management, 1998)." ERP is an enterprise-wide information system, which allows data that is not only from manufacturing or domestic operations to be shared throughout the enterprise. ERP also provides other modules of the global enterprise (Gould, 1997).

ERP is a cross-sectional enterprise system, which can integrate business processes (O'Brien, 2002). It helps enterprises to handle supply chain, which includes delivery of goods, stock management, customer orders management, production planning and management, shipping, accounting, human resources and other activities (Ragowsky & Somers, 2002). ERP imposes its modules based on the company's strategies, organization characteristics and culture to integrate all business activities to increase its profit (Davenport, 1998). Following MRPI and MRPII, the ERP is not a whole new domain, which integrates the operation information of each business unit to help decision makers get up to date information (Wang & Fei, 1999).

2.2 ERP customization

A common problem when adopting package ERP has been the issue of "misfits," that is, the gaps between the functionality offered by the package and that required by the adopting organization (Davis, 1988; Lucas, Walton & Ginzberg, 1988). Soh et al. (2000) observe there are three types of misfits: data, process, and output. Data misfits arise from incompatibilities between organizational requirements and ERP package in terms of data format, or the relationships among entities as represented in the underlying data model. Functional misfits arise from incompatibilities between organizational requirements and ERP packages in terms of the processing procedures required. Output misfits arise from incompatibilities between organizational requirements and the ERP package in terms of the presentation format and the information content of the output. When a misfit occurs, organization needs to choose either adapting to the new functionality or customizing the package.

Manhasset (2000) shows that businesses change too much existing process to fit ERP system might cause implementation failure. In that case, proper customization might be a better solution. Levin, Mateyaschuk and Stein (1998) find that proper ERP customization can shorten the ERP implementation time. Moad (1995) points out businesses need to set flexible manufacturing system by customization. Proper customization might be the best solution. The proper application of customization is important for any packaged software system (Lucas et al., 1988); it is acute for ERP for two reasons (Haines, 2009). First, any misfit between organizational requirements and packaged system can be disruptive to an organization's operations. Second, ERP customization can be especially intricate and therefore difficult and expensive because of the complexity (Gattiker & Goodhue, 2002).

Customization can be distinguished into three types: configuration, extension, and modification (Haines, 2003). Configuration activities, which usually amount to changing entries in tables or configuration files, are supported by ERP consultant companies. Most ERP consultant companies also allow extension of their system by supporting common interfaces. Modification is an alteration that is usually not supported by ERP consultant companies. This includes code changes and other more invasive alterations.

Rothenberger and Srite (2009) mention that customization involving extensive additions to ERP system or modifications of ERP system code may compromise a project success because too much customization increases costs and limits maintainability. In particularly, upgrading customized project is labor-intensive. Stedman (1999) points out reasons for lessening customization are to fasten implementation time and to decrease the complexity of updating new versions. We summarize the effects of customization as follows:

(1) Affecting the project progress: Before business implementing ERP system, gap analysis is needed because the functionality of packaged ERP system cannot satisfy all the business requirements. In the process of ERP implementation, the project progress will be delayed if there is higher need for customization.

(2) Increasing project costs: Enterprises estimate the project costs before implementing the ERP system. During the implementation process, enterprises will need to increase the budget for customization to solve the differentiation issues. Apart from the software cost for building the ERP system, the invisible opportunity cost is even more astonishing (Stephen, 1999). A survey from Forrester Research on the U.S. top 1,000 enterprises found that "cost" is the major consideration for enterprises to decide whether to customize the system during implementation or not since customization brings extra project costs (Davis, 1998).

(3) Difficulty in maintenance and inconvenience in system updates: Consultants focus on the overall planning in the beginning implementation period and help the end user to accustom to the new system. If customization is needed, consultants should use plug-ins to avoid changing ERP Script. Davis (1998) noted the reason avoiding ERP customization is the software for keeping and updating the customized program is more complicated and the software needs to ensure the customized program can be carried out normally under the updated system. Therefore, keeping the system will be more difficult after updating the system if the system structure is changed.

(4) Increasing the workload for I.T. (Information technology) staff: Consulting company designs the urgent reports at the beginning of implementation and the remaining reports are developed by I.T. staff afterwards. The workload for I.T. staff will increase if there are too many customization requirements.

However, despite a growing awareness of the difficulties and cost implications of customizations (Wu, Shin & Wu, 2005) and concerted efforts to curb them, most organizations end performing at least some customizations. Nevertheless, it is also important to note that customization can play a positive role (Gattiker & Goodhue, 2005). All in all, enterprises should fully understand the necessity of customization suggested

by end user during implementation and corporate with consultants to ensure a smooth production to reduce the mentioned effects.

2.3 ERP implementation strategy and process

To decide which ERP implementation strategy to use is the next step after enterprises decide to implement ERP system. The choice of implementation strategies depends on organizational characteristics such as size, structure, complexity and controls of organization. Welti (1999) mentions that implementation strategy should be adopted based on availability of human resources, expertise, financial resources and time. There are three main implementation strategies: Step by step, Big bang and Roll out (Arinze & Anandarajan, 2003; Bancroft, 1996; Reijers, 2003; Welti, 1999). The difference between these implementation strategies is the risk an organization takes and the opportunity to reduce data clutter because of the incompatible. The advantages and disadvantages about these three strategies are presented in Table 1.

All ERP vendors have the clear and complete implementation. Therefore, the probability of implementation success will be raised as long as enterprises continue by the process required by ERP vendors. We introduce three example software companies: SAP, Oracle and DSC.

(1) SAP: SAP is the world's biggest ERP software company. Its major product is R/3 (Realtime/3). ASAP (Accelerated SAP) Road map provides the methodology to optimize SAP System. ASAP is divided into five phases. The primary activities in each phase are shown as Table 2.

(2) Oracle: Oracle proposed the AIM Method (Application Implementation Method) which has six phases. AIM implementation process is shown in Table 3.

(3) Data Systems: The TIPTOP ERP developed by Data Systems employed the TIM method (TIPTOP Implementation Methodology) which includes six phases. The primary activities are shown in Table 4.

In conclusion, there is difference in the phases of the three mentioned companies though, the spirit is the same. The steps are similar including Project starting phrase, Current situation analysis phrase, User training phrase, Differential analysis phrase, Preparation before production phrase and System go-live phrase.

2.4 Effects of consultants on ERP customization decisions

When customization, consultants have a central place because they are the bridge linking enterprise and consulting company (Chang, 2002). They are the key factors to decide the success of implementation. During ERP implementation, Welti (1999)

Table 1 ERP Implementation Strategies

	Method	Advantages	Disadvantages
Step by step	Batch import of each module.	1. Llittle human resources are involved. 2. Module import enables employees to increase experience and knowledge. 3. Operation is not affected by the severe change. 4. Well-planned to avoid recurrence of failure.	1. Long duration may result in losing drive and patience of employees. 2. Difficult to identify the superiority of ERP system if modules are implemented in batches because ERP system stresses stresses on its holistic. 3. Holistic of system will be affected because employees try to customize the system because of convenience. 4. Employees are used to the old system if both old and new systems are in use.
Big bang	Phase out the old system and implement the new system.	1. Short period of implementation so employees are more aggressive. 2. Benefits are achieved faster. 3. Employees have higher sense of crisis if old system is phased out. 4. Draw the attention of senior management because all employees are asked to involve in implementation since time is urgent.	1. Enterprise can hardly afford the huge change. 2. Massive labor and time cost are involved. 3. Unsuccessful implementation will lead to enterprise crisis.
Roll out	Carry out the system in one of the internal company. Copy the experience to others after success.	1. Avoid massive change. 2. Implement the module of one company will show immediate benefits.	1. There is time lag between the integration of different companies. 2. There will be problems in consolidated statements easily.

Table 2 ASAP Implementation Process

	Phase	Primary activities	Key success factors
1	Project Preparation Phrase	1. Initiated project planning and technical requirements planning. 2. Project program establishment and starting. 3. Quality management.	1. Executives Promise. 2. Actual planning and expectation setup.
2	Business Blueprint Phase	1. Project management. 2. Project team training. 3. System environment development. 4. Organizational structure and process redefinition. 5. Quality management.	1. Availability of project team from customer side. 2. Availability of experienced consultants. 3. Clear definition of scope.
3	Realization Phase	1. Project management. 2. Project team training. 3. Configuration setting. 4. Interfaces setting. 5. Integration and testing of the function of statement preparation. 6. Documentation of end user manual and end user training. 7. System management. 8. Quality management.	1. Quick decisions. 2. No major change in project scope and focusing on the data transmission and interface.
4	Final Preparation Phase	1. Project management. 2. End user training. 3. System management. 4. Detailed project planning. 5. Quality management.	1. Interface testing. 2. Acceptance of users (e.g., file export, interface).
5	Go Live and Support Phase	1. Prodction support and on-going support.	1. Go live plan. 2. End user training. 3. Long-term strategy for assistance establishment.

Source: Hiquet and Kelly (1998).

Table 3 AIM Implementation Process

Stage	Primary activities	Critical factors
1 Definition	1. Work on project plan and expectation. 2. Confirm project scope and strategy. 3. Build project team and work plan. 4. Evaluate risk of the project.	1. Executive promise and support.
2 Operation Analysis	1. Understand operation management and technical character. 2. Collect and analysis current operation. 3. Train the project team. 4. Build up blueprint.	1. Participation in training of related employees and successful installation of software and hardware. 2. Project team's understanding of Oracle Application.
3 Solution Design	1. Build up operation model. 2. Integrate technique and operation. 3. Train the project team to solve problems.	1. Involvement of professionals. 2. Acceptance of change.
4 Build	1. Build solid system structure. 2. Test the system at the same time.	1. Build up solutions. 2. Establish final solutions. 3. Test the solutions.
5 Transition	1. Test before production. 2. Train, prepare data and test in each unit. 3. Build up a formal operation environment.	1. Effective user training. 2. Error-free in each operation test. 3. Coordination of production process.
6 Production	1. Observe production status. 2. Plan for future direction.	1. Effective support from Oracle.

Source: Oracle AIM handbook (Buchan et al., 1999).

Table 4 TIM Implementation Process

	Stage	Primary activities
1	Project Committee and Executive Team	1. Establish division of labor of project team members and decision mechanism.
2	Kick-off Meeting	1. Advertise the goal and determination for ERP project. 2. Introduce team members and the division of labor. 3. Introduce the implementation schedule.
3	Survey and Diagnosis	1. Consultants from Data Systems to understand the operation model and information process.
4	Application Training	1. Consultants introduce the standard operation and functions of TIPTOP. 2. Suggestions on process.
5	Operation Training	1. Process planner to understand the operation. 2. Propose differences in detail.
6	S.O.P. Modeling	1. Set up S.O.P..
7	Differential Analysis & Customization	1. Review the between process and system and find out the solutions.
8	Data Migration & Entry	1. Convert data from the old system. 2. Key-in related information.
9	Business Flow Simulation	1. KM and KU to be familiar with the future operation model. 2. Found out potential differentiation.
10	Balance Check & Implementation	1. Calculate the balance of each module. 2. Key-in (or convert) the correct opening balance.
11	System Go-live	1. New system go live.
12	Project Review Meeting	1. Project costs and schedule control. 2. Review the goal in each phase. 3. Resolve the major outstanding issues.

Source: Data Systems (2000).

points that consultants are responsible for: (1) ensuring the project is in line with the expected schedule; (2) providing the project team with consultation, support and training; (3) showing, supervising and confirming the project planning; (4) solving the problems with the experts in software company; (5) system setup and customization; (6) keeping the quality of project; (7) recording the process documentation. As a result, the capabilities, behavior patterns and communication abilities of consultants are important. At the beginning of implementation, consultants need to frame a project schedule with the customers. However, the project costs are always more than expected because of irresistible factors in which customization is the major one. The importance of consultants is shown because they have to understand the differentiation between and the system the need of customers (Soh et al., 2000). The different stands between ERP suppliers and customers are the major failure factor (Swan, Newell & Robertson, 1999).

Most ERP consultants strongly support lessening implementation risk, reduce implementation cost, avoid negative impacts on system performance, ease adoption of future package upgrades, reduce maintenance costs, and foster adoption of process-oriented "best practices (Brehm, Heinzl & Markus, 2001)." Organizational users, however, often demand to have the ERP package customized to meet their operational needs, reduce disruption to established ways of doing things, and meet regulatory requirements and customer needs. Consultants need to assist customer to make best choice.

In typical ERP system practice, the percentage of the content meeting the need of enterprises is about 70% and the remaining 30% needs the guidance from experienced and professional consultants (Bingi et al., 1999). Consultants should aid the end user to understand the effects of customization on enterprise and help the end user in knowing which needs are necessary to lower the customization requirements. The major responsibility of consultants is to assist customers to implement ERP system successfully. While customization is only one of consultants' jobs, consultants focus on overall planning. Consultants should responsible for checking whether the system satisfies the organizational culture, industry characteristics and operation process after production and providing the best solutions without customization. During the implementation, consultants should tell the end user which customization requirements need to be done before production and others can be deferred and developed after production. Endless demands can increase the risk of implementation, delay in schedule and the costs of project and gradually affect the schedule and the result of ERP implementation.

2.5 Factors consulting company accepting ERP customization

The biggest problem most enterprises face is whether to choose customization or not at the beginning of implementing ERP system (Craig, 1999). A few users try to avoid customization to decrease the complexity of implementation and reduce the

costs. Customization is the only way for the ERP system to meet all needs of customers. Referring to Haines (2009), we summarize there are six factors for consulting company to accept the customization appointment in three categories as follows.

2.5.1 Product factors

(1) Enterprise's critical demand for customization: In the differential analysis conducted during ERP implementation, consultants discuss the functions that cannot satisfy the needs with the customers. They list out the unsolvable problems and ask for the coordination of customers. Consultants put the demands in order by the necessity of customization and habitability. Consultants develop the customization based on the importance, necessity and urgency of customers' needs to ensure the production is smooth.

(2) Commonality demand: The development of ERP system is increasingly complete and mature. Apart from the sophisticated development of both software and hardware equipment and the techniques of development employees, absorbing practical experience through the coaching process of consultants play an important part. Customers are able to solve their problems with a more perfect system. Throughout the coaching process, consultants learn more about the market needs by discussing customization with customers.

2.5.2 Internal factors

(1) Customer accepts higher customization cost: Consulting company will accept customization if the customization requirements do not affect the structure of the whole system; and customers accept the higher charges for customization.

(2) Increase the output value of consultants to achieve performance: Consultants' performance is considered based on the coaching hours and the customization hours. Thus, consultants will also consider the value output other than the appropriateness of demands.

2.5.3 Customer relation

(1) Positive interaction between two parties: The probability of system production increases when the interaction between consulting company and enterprise is fine. Consultants accept customization requests such as adjustment of reports or addition of fields.

(2) Focus on future benefits: Not do the two parties cooperate in the present, but also focus on the future. Consulting company should accept customization request if it is sure the customer will bring greater benefits to the company in the future.

3. Research designs and methodology

3.1 Conceptual structure of research and the selection of case study

The analytical foundation of this paper is "the factors why the consulting company accepts the task of customization" to explore the factors in case company D during its assistance for ERP implementation. The analysis of case study is our basic model, followed by the questionnaire for employees in D Company. The data collected from the questionnaires is analyzed and authenticated to generalize the factors for the consulting company to accept the task of customization.

D Company was established in 1982. There are about 1,200 employees in present and its capital is about 1.2 billion. Its capital was raised to nearly 4.8 billion after it had been acquired by Whitesun in 2008 and it has become the biggest ERP application company in Taiwan. For getting market share in Chinese market, several operating bases were set up in Shanghai, Guangzhou, and Beijing in 2002; the Asia-Pacific market is also valued so the company set up operating base in Vietnam in 2008. In a survey conducted by Common Wealth Magazine in 2007, 53% of the top one thousand manufacturers in Taiwan are the customers of D Company; and around 31% of the top five hundred companies in the service industry are served by D Company as well.

The design and development of MRP was the business focus in the early establishment stage. After accumulating experience in software design and integration for years, D Company has designed suitable ERP products for large-sized, medium-sized and small-sized enterprises. Enterprises are able to choose appropriate products according to their business scales. D Company pays a lot of attention on Product research and development. Out of all employees, 22% of them are R&D staff, 21% of them are consultants and 43% of them are responsible for technical services. They put technique development and customer service into the first place so the consultants have rich consulting experiences. In 2002, D Company had 3,679 customers and in 2008, the number has increased to over 10,000. Its customers include manufacturing industry, trading industry, logistic industry and finance industry. This can explain why this paper selects D Company as the example to conduct exploratory study.

3.2 Questionnaire design and object

This paper carries out the analysis by conducting questionnaire of which the contents are designed based on the results in literature study while the object of this paper is consultants in D Company. The questionnaire is formed by descriptions of scenario simulation cases. Such scenarios are divided into three cases:

(1) Company A is a significant electronics listed company. Consultants wish to establish the image of authority by the successful implementation although they have already had years of experience in this industry. Consultants are devoted in this case in hoping that other companies in this industry can gradually implement the ERP system provided by the consulting company. Company A has expanded so rapidly that the current system is no longer suitable to use. To meet Company A's demand, the consulting company is stressed to put the new system into practice by the very tight schedule.

(2) Company B is a medium size company manufacturing power tools. Consultants wish to accumulate more experiences although he has enough experience in the industry and is able to help customers put their new system into practice quickly. During the coaching process, consultants find that the customer tends to customize the system to fulfill their demands; they do not care whether the operation process conforms to internal auditing and control. To meet Company B's demand, the consulting company is stressed to put the new system into practice by the very tight schedule.

(3) Company C is a traditional textile company. The industry characteristics are complicated and diversified so consultants pay more attention to the industry characteristics and hope to learn more experience and knowledge in this case. To meet Company C's demand, the consulting company is stressed to put the new system into practice by the very tight schedule.

The three situations above are the basic of our questionnaire. Data structure aspect, system function aspect and report output aspect are used to explore the decision factors for customization. Cross-analysis and comparison are done on the differentiation of industries, industrial representative and the familiarity to the industry of the software company.

The contents of questionnaire are mainly divided into three parts. The first part: a brief description of the reasons and nature of the questionnaire and the situation simulation cases. The second part: design of the questionnaire contents. Contents are described with situation cases and three customization types are employed as aspects which are data structure aspect, system function aspect and report output aspect. There are six factors under each aspect, which are "critical demand for production customization," "commonality demand," "acceptance of higher customization charges," "increase consultant's output value to achieve performance," "good communication among two parties," "focus on future benefits." Likert Scale is employed for measurement and the five levels are "very unimportant," "unimportant," "average," "important" and "very important." In the score 1 to 5, 1 represents the lowest importance while 5 represents the highest importance. The contents of questionnaire are summarized in Table 5. The third part: the basic background of the questionnaire takers.

Table 5 Questionnaire Design

	Code	Variable	Definition
Data structure aspect	X1	critical demand for production customization	During the stage of differential analysis, consultant lists out the customization items in the order of essentiality to determine the order of customization. And whether the consultant accepts the order proposed by the customer?
	X2	commonality demand	During the consulting process, consultant accepts customization because it is necessary for most enterprises and reflects the actual needs of the market throughout the discussion with customer.
System function aspect	X3	acceptance of higher customization charges	If the demands are no necessary for production and not common, will customer still accepts the higher charges for customization?
	X4	increase consultant's output value to achieve performance	Performance is considered based on the coaching hours and also the customization hours. Thus, consultants will also consider the value output other than the appropriateness of demands.
Report output aspect	X5	good communication among two parties	Good coordination between enterprise and consultant during implementation and smooth process of project. Will consultant accept customization if the demands do not affect the system?
	X6	focus on future benefits	Ensure the customer will bring greater benefits to the company. Will consultant accept customization if future benefits are even greater although he has to pay the cost in the short run?

Source: Summarized by this study.

4. Analysis of empirical results

This paper aims at exploring the decision factors for ERP customization from the viewpoint of consulting company. The research samples are consultants in D Company. Questionnaires were sent via e-mail. We would contact the test taker if we have not received the reply after 10 days of the delivery of questionnaire and asked whether he has received the questionnaire or he needed further explanations to finish it. We also contacted the test taker in the next week if he did not return the questionnaire. Ninety questionnaires were distributed and the responded questionnaires were sixty-one, the response rate is 68%. Exempting three inappropriate questionnaires, we had fifty-eight valid questionnaires. The response rate is 64%.

4.1 Descriptive statistics

Analysis results for the descriptive statistics are summarized in Table 6. (1) Gender: the proportion of male and female consultants in D Company is average; (2) Age: consultants in D Company are most likely between 31 ~ 40 year-old, in the next place are consultants between 26 ~ 30 (incl.) year-old. Hence, the professionalism of consultants is formed by experiences and continuous learning. (3) Academy degree: Most of the consultants' degrees are bachelor followed by master.

Table 6 Descriptive Statistics of Basic Information of Test Takers

Background of test takers		Number of people	Percentage
Gender	Male	32	52.5%
	Female	29	47.5%
Age	21 ~ 25 (incl.) year-old	2	3.3%
	26 ~ 30 (incl.) year-old	7	11.5%
	31 ~ 35 (incl.) year-old	23	37.7%
	36 ~ 40 (incl.) year-old	21	34.4%
	41 ~ 45 (incl.) year-old	8	13.1%
	46 ~ 50 (incl.) year-old	0	0%
	51 ~ 55 (incl.) year-old	0	0%
	56 or above	0	0%
Seniority of consultant	Above 10	11	18%
	5 ~ 10 years	23	37.7%
	Below 5	27	44.3%
Education	Doctor	0	0%
	Master	16	26.2%
	Undergraduate	38	62.3%
	Vocational school or below	7	11.5%
Residency	Northern Taiwan	11	18%
	Central Taiwan	36	59%
	Southern Taiwan	14	23%

Source: summarized by this study.

4.2 Measure of reliability and validity

4.2.1 Reliability analysis

The reliability test results of each aspect in this paper are shown in Table 7 and most of them reach 0.7 or above. The reliability for situation 1 is relatively low probably because the test takers were still unfamiliar with the questionnaire at the beginning. However, the average reliability of this questionnaire is over 0.9. The Cronbach's α coefficient is over 0.7, which implies the degree of internal consistency of the questionnaire is high (Nunnally, 1978).

Table 7 Reliability Analysis of Each Aspect

Situation / Aspect	1	2	3
	Cronbach's α		
Data structure aspect	0.591	0.721	0.702
System function aspect	0.801	0.848	0.871
Report output aspect	0.699	0.787	0.780
Reliability of situation	0.746	0.817	0.844
Total reliability		0.913	

Source: Summarized by this study.

4.2.2 Validity analysis

Content validity represents a systematical test to examine the relevance of contents. This paper referred to related literature and collected measurements from literature. The questionnaire was amended after consulting the opinions of scholars who specialize in information management to ensure the items in questionnaire reflected the aspects in our research framework effectively. Face validity only shows the validity of test adaptors or test takers subjectively. To ensure all test takers understand the items in questionnaire, we asked two management and two seniors in I.T. department to take the pre-test. We further discussed the contents of the questionnaire and amended the questionnaire. Hence, both the content validity and the face validity of the questionnaire reach the significance level.

4.3 Analysis of questionnaire results

4.3.1 Descriptive analysis of overall aspects

From the summary in Table 8, we learnt that when consultant considers whether to customize the system, the total scores of "System function aspect" are the lowest, which are 199.84, 196.35 and 202.33 respectively. This implies that the consultant concerns

more about "Data structure aspect" and "Report output aspect" rather than "System function aspect." Moreover, the mean of "critical demand for production customization" and "demand commonality" is mostly above 4. We infer that consultant agrees with these two items more than the others. The result is consistent with the viewpoint that the communication between the consultant and the end user throughout the implementation process is important (Bingi et al., 1999). Furthermore, the mean of "focus on future benefits" is between 4 ~ 3.5 indicating that this is the second important issue for the consultant. A possible explanation is that the consulting company focuses on long-term profits because it cannot survive without making profits. The profit-making ability becomes a critical evaluation against consultant. Lastly, the mean of "increase consultant's value to achieve performance" is the lowest which means that the consultant do not value "increase consultant's value to achieve performance." The result is consistent with the viewpoint that consulting company values long-term profits. An analysis of three situation simulations is illustrated as below.

Situation simulation 1 -- Electronics industry, industry representative, good familiarity with the industry, high pressure for production schedule:

Electronics industry is one of the most important industries in Taiwan. In Table 8 we found that when consultants are familiar with the industry, "Data structure aspect" is regarded as the most important consideration for customization though the pressure for production schedule is high. The total score for "Data structure aspect" is 231.66 and is way above "System function aspect" scoring 199.84 and "Report output aspect" scoring 224.00 because A company is representative in its industry. Data structure is the core of the package software. If the ERP system provided by the consulting company cannot fulfill A company's demands, the reinvention will be needed. In addition, consultants recognize that "critical demand for production customization," "demand commonality" and "focus on future benefits" are the most important ones. Their means are much higher than other items' means. We can conclude that consultants wish to gain more experiences and learn the system build-up technology and after-service ability by serving indicative enterprises. Such experience will be converted to consultants' own techniques and increase their competence in this industry. The successful experience can be copied to similar enterprises and shorten their implementation duration. In the meantime, consulting company can establish its reputation for seeking various benefits in the long run. In the contrast, "increase consultant's value to achieve performance" is not the main factors for consultants in considering customization.

Situation simulation 2 -- Traditional industry in medium-small size, non-representative in the industry, fair familiarity with the industry, high pressure for production schedule:

Table 8 Summary of Descriptive Analysis

Situation / Items	1						2						3					
	Data structure aspect		**System function aspect**		**Report output aspect**		**Data structure aspect**		**System function aspect**		**Report output aspect**		**Data structure aspect**		**System function aspect**		**Report output aspect**	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Q1	4.16	0.778	3.62	1.051	4.15	0.853	3.90	0.831	3.36	1.212	4.03	0.856	4.30	0.863	3.48	1.233	4.02	0.904
Q2	4.18	0.695	3.52	1.043	4.05	0.872	3.75	0.856	3.28	1.113	3.87	0.939	4.33	0.851	3.51	1.090	4.00	0.856
Q3	3.49	0.924	3.03	0.875	3.57	1.040	3.51	0.829	3.10	0.961	3.82	0.866	3.69	1.025	3.38	0.986	3.70	0.919
Q4	3.16	1.098	2.85	1.030	3.20	1.123	3.10	1.150	2.87	1.040	3.28	1.067	3.03	1.169	2.77	0.990	3.31	0.992
Q5	3.69	1.009	3.16	0.952	3.52	0.993	3.47	0.833	3.20	0.963	3.61	0.971	3.72	0.878	3.23	1.071	3.60	0.887
Q6	4.10	0.831	3.46	0.993	3.88	0.904	3.59	0.920	3.51	0.977	3.95	0.956	4.07	0.793	3.54	1.010	3.85	0.853
Total scores	231.66		199.84		224.00		213.19		196.35		229.32		235.16		202.33		225.01	

Source: summarized by this paper.

Note: Q1: critical demand for production customization; Q2: demand commonality; Q3: accept higher customization charges; Q4: increase consultant's value to achieve performance; Q5: good communication with customers; Q6: focus on future benefits.

Referring to Table 8, we learnt that the scores of "Data structure aspect," "System function aspect" or "Report output aspect" in Situation 2 are much lower than the other two situations. Due to the particularity of the industry, the duration, human resources and costs for system build-up cannot be copied in other enterprises. The costs cannot be shared. Meanwhile, the system for this industry requires more maintenance. The total costs increase but the derived benefits are limited. Consultants will be less willing to customize the system. For each aspect, the score of "Report output" is the highest. Consultants are more willing to provide "Report output" service because it involves less technical issue and less time. In each item, the scores of "critical demand for production customization," "demand commonality" and "focus on future benefits" are the highest. This result is in accordance with the mindset and attitude of consultants during evaluation.

Situation simulation 3 -- Special traditional industry, non-representative in the industry, low familiarity with industry, high pressure for production schedule:

From Table 8, we learnt that the score for "Data structure aspect" is higher than the scores for "System function aspect" and "Report output aspect" in special traditional industry. It implies that consultants will face the same customization demands for ERP implementation in this industry because the industrial environment, characteristics and operation process of enterprises are the same. Such customization demands, important and urgent to the industry, can be solved by module design that will be one of the ERP system functions. This customization process is regarded as a learning opportunity for consultants. Consultants concern about this aspect because they can utilize their professional techniques and enhance their learning aptitude. In each item, the scores for "critical demand for production customization," "demand commonality" and "focus on future benefits" are the highest. This result shows that consultants will design reports to meet the enterprises' needs when it is requested for specific industry.

Summary of three situation simulations:

In both A and C company, consultant consider "Data structure aspect" as the most important factor of customization. In B company, consultant consider "Report output aspect" as the most important factor of customization. From the results, we realize that consultant emphasize on different factors of customization in different industries. In all three situation simulations, the scores for "critical demand for production customization," "demand commonality" and "focus on future benefits" are the highest and "increase consultant's value to achieve performance" is lowest.

4.3.2 Test on the effects of customer's characteristics on customization

The results reflected in Table 9 indicate the level of differentiation when consultants consider customization based on "Data structure aspect," "System function aspect" and

Table 9 Summary of the Effects of Customer's Characteristics on Customization

Situation		Mean	SD	Significance (two-tailed)
Data structure aspect	Mated pair 1 S11-S21	0.23611	0.52909	**0.001**
	Mated pair 2 S11-S31	-0.05738	0.63383	0.482
	Mated pair 3 S21-S31	-0.29722	0.66673	**0.001**
System function aspect	Mated pair 1 S12-S22	0.05738	0.64828	0.492
	Mated pair 2 S12-S32	-0.04098	0.73828	0.666
	Mated pair 3 S22-S32	-0.09836	0.68811	0.269
Report output aspect	Mated pair 1 S13-S23	-0.03333	0.58930	0.663
	Mated pair 2 S13-S33	-0.01695	0.53130	0.807
	Mated pair 3 S23-S33	0.01389	0.58488	0.855

Note: 1. S11, S12, S13: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 1.
2. S21, S22, S23: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 2.
3. S31, S32, S33: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 3.

"Report output aspect" towards different company situations. The T test for paired sample of "Data structure aspect" in Table 9 shows there is 1% in significance level in Situation 1 and Situation 3 comparing that of Situation 2. It implies consultants will do customization for "Data structure aspect" considering the characteristics of customers. Consultants are still willing to carry out customization although they have to perform under pressure due to the short schedule for production when the customers are electronics or specific industry, the customer has industry representative, or the consultants are not familiar with the industry. The result agrees with the previous result that consultants increase their understandings of industry characteristics, environment and business process through the customization of changing the core of ERP system. Consultants eventually extend their professionalism and increase their own values while assisting their customers.

Table 9 indicates there is no significance differentiation in three situations when consultants consider "Data structure aspect" and "Report output aspect." This implies consultants will not have different opinions on "Data structure aspect" and "Report output aspect" for customers of different natures. A clear budget plan and control is one of the key success factors for enterprises implement ERP system (Hsieh, 2000). Since customizing "System function aspect" goes against the standard operation process, consultants tend to suggest customers to reengineer business process under limited budget

rather than customizing the functions of the system. In addition, consultants tend to customize report output if time and cost is sufficient. It is because special report format is required for different industries. Customizing report output will not change core code of the system that affects future maintenance and updates of system. Hence, consultants do not consider the previous characteristics of customers in evaluating customizing report output. In conclusion, not only do consultants consider the customer characteristics, but also the key elements that need to be customized.

4.3.3 Test on the effects of consultant's characteristics on customization

Table 10 explains the test result of whether gender of consultants affects ERP customization. There is no significant influence of consultant's gender on the customization decision for "Data structure aspect," "System function aspect" and "Report output aspect" regardless of customer's characteristics. Only when the customer belongs to specific industry and the consultant is unfamiliar with the industry, there is 10% differentiation level for customization in "Report output aspect" among male and female consultants. In another words, male consultants tend to customize report format than female consultants do.

Table 11 indicates the test result of whether the seniority of consultants affects ERP customization. In Situation 1, Table 11 shows the greatest differentiation happens in "Data structure aspect" and "System function aspect" in the item of each aspect, and their P values are 0.094 and 0.024 respectively. With further analysis, the greatest differentiation happens to consultants with seniority between 5 ~ 10 years and those below 5 years; whereas the differentiation for consultants with seniority of above 10 years and 5 ~ 10 years is not great. Such finding means consultants will have different attitudes on customization that needs to change the core program code depending on their seniority. Although consultants are under pressure of production schedule, the customers are in the electronics industry and have industry representative; consultants are familiar with the industry as well. The difference in handling customization of consultants may due to their coaching experiences. There is significant differentiation in working performance for different age groups (Huang, 2005). The golden age of consultants is around 5-10 years in which consultants are committed to create long-term value. Instead of considering the costs and benefits of solution to customization, consultants consider the benefits brought by cost benefit in a deeper aspect. Regarding consultants with less than 5 years experience, they are more conservative against the change of ERP core during customization because their professionalism and customer experience are still weak and insufficient. This can explain why different age groups show great differentiation in the attitude towards customization that changes the ERP core.

Table 10 T Test Statistics against Gender

	Gender	Mean	SD	*F* test	Significance
S11	Male	3.7760	0.57984	2.205	0.143
	Female	3.8218	0.44305		
S12	Male	3.2396	0.74648	0.045	0.832
	Female	3.3161	0.66270		
S13	Male	3.7344	0.54355	0.459	0.501
	Female	3.7321	0.69882		
S21	Male	3.5469	0.63250	2.518	0.118
	Female	3.5595	0.55037		
S22	Male	3.2240	0.83988	0.028	0.868
	Female	3.2126	0.74655		
S23	Male	3.8177	0.54929	0.307	0.582
	Female	3.6954	0.76515		
S31	Male	3.8490	0.69090	2.090	0.154
	Female	3.8621	0.47989		
S32	Male	3.3437	0.77244	0.274	0.602
	Female	3.2874	0.90402		
S33	Male	3.7527	0.45107	2.850	0.097
	Female	3.7474	0.77871		

Note: 1. S11, S12, S13: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 1.
2. S21, S22, S23: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 2.
3. S31, S32, S33: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 3.

In Table 11, it shows in Situation 2 and Situation 3 that the greatest differentiation in items of each aspect is "System function aspect" with P values of 0.033 and 0.049 respectively. This result represents when consultants are under schedule pressure in handling non-representative customers; regardless of their familiarity of the industry; the seniority of consultants do not affect their consideration for "Data structure aspect" and "Report output aspect" but the "System function aspect" is obviously affected. We found that consultants who have 5-10 years experience tend to construct standard functions of ERP system for that special industry to apply because there is no or the current ERP system cannot fulfill the needs of the specific industry. Consultants have considered the long-term benefits to achieve a win-win-win situation. Consultants with 5 or less years of

experience are not professional enough so they are not confident in customization. Hence, there is great differentiation in the attitude and cognition of customization that changes ERP core for these two groups.

5. Conclusions and suggestions

The purpose of this paper is to explore the reasons and factors why companies want to customize their ERP system when implementing it and discover the decision factors for customization from the viewpoint of the consulting company by conducting the case study, employing the D company to investigate the issues we have pointed out by interviews and followed by a questionnaire survey to carry out a deeper analysis. The results of the questionnaire analysis indicate that consultants pay more attention on "Data structure aspect" and "Report output aspect" than "System function aspect." That shows that consultants take into consideration cost and time when evaluating the ERP customization, especially for the one which will change the core function of the ERP system. Among the six factors, "critical demand for production customization" and "demand commonality" are most emphasize by consultants while "increase consultant's value to achieve performance" is the least important. The major reason is that consultants are more concerned about the necessity and long-term benefits than short-term increase in performance.

According to the situation analysis, consultants' willingness for customization is higher in mainstream industries such as the electronics industry because they could build up their reputation and at the same time copy the experience. Regarding specific industries, consultants are still willing to customize the ERP system due to their own drives for enhancing their ability and self-learning. For non-representative traditional industries, consultants' willingness for customization are relatively lower because the manpower and time costs are higher while long-term benefits are not outstanding. Their service areas are limited to report output service which requires the minimum manpower and time costs.

Based on the analysis of the gender of the consultant, the result shows that gender has no significant influence on "Data structure aspect," "System function aspect" and "Report output aspect" except that, when the customer is in specific industry and consultants have little understanding in that industry, male consultants tend to customize the format for report output compared to female ones. Moreover, based on the analysis of the seniority of the consultant, the result indicates great differentiation in the attitude of consultants with different seniority toward to customization which changes ERP core functions. The main reason is that the consulting experience varies with seniority. Senior

Table 11 Summary of One-Way Analysis of Variance

Situation simulation	Aspect	*F* test	P value	Multiple tests				
				Seniority of consultant		Mean difference	SD	P Value
S1	S11	2.469	**0.094**	Above 10 years	5 ~ 10 years	0.24769	0.18455	0.378
					Below 5 years	-0.06229	0.18007	0.936
				5 ~ 10 years	Above 10 years	-0.24769	0.18455	0.378
					Below 5 years	-0.30998	0.14285	0.085
	S12	3.987	**0.024**	Above 10 years	5 ~ 10 years	0.12978	0.27783	0.734
					Below 5 years	-0.39169	0.27109	0.378
				5 ~ 10 years	Above 10 years	-0.12978	0.27783	0.734
					Below 5 years	-0.57246	0.21505	0.027
	S13	0.076	0.927					
S2	S21	1.872	0.163					
	S22	3.622	**0.033**	Above 10 years	5 ~ 10 years	0.20883	0.27783	0.734
					Below 5 years	0.36364	0.27109	0.378
				5 ~ 10 years	Above 10 years	-0.20883	0.27783	0.734
					Below 5 years	-0.57246	0.21505	0.027
	S23	0.865	0.427					
S3	S31	1.356	0.266					
	S32	3.181	**0.049**	Above 10 years	5 ~ 10 years	0.23584	29411	0.703
					Below 5 years	-0.33502	28698	0.477
				5 ~ 10 years	Above 10 years	-0.23584	29411	0.703
					Below 5 years	-0.57085	22765	0.039
	S33	0.175	0.840					

Note: 1. S11, S12, S13: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 1.
2. S21, S22, S23: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 2.
3. S31, S32, S33: Customization for "Data structure aspect," "System function aspect" and "Report output aspect" in Situation 3.

consultants may concern more about creating long-term values in assessing customization than junior ones do.

The results show that, in ERP customization, consultants take account of long-term benefit for their clients instead of increasing short-term performance and senior consultants focus more on value creation in the long run. The result of this study can provide consulting companies an objective assessment mechanism on ERP customization. The main contribution of this paper is that in the future, consultants may refer to the decision factors for ERP customization in it and design a customization-related checklist form into which these factors they emphasize are translated to provide them with a quick reference index for customization assessment. This index may enhance the quality of the assessment of consultants on consistency and preciseness. This paper also suggests the consulting company to focus on "critical demand for production customization," "demand commonality" and "focus on future benefits" when designing their own checklist focusing on so that consultants can get quick assessment to the customized situation and eventually increase the quality of communication with the appointment company. There are two suggestions we made. (1) We suggest that customized checklist can be designed separately based on various situations or enterprises because the assessment methods may vary with different industries. By doing this, consultants are able to pick the relevant checklist quickly to increase the quality and effectiveness of decision-making. (2) We suggest consulting company integrates and classifies consultants according to seniority, so apprenticeship practice is suggested. In this practice, senior consultants lead the new consultants to make the decision together. Such practice assists all consultants to have a uniform decision-making process and approach so as to grasp the customer's needs and provide services with equal quality.

Limitations of this paper are as follows: (1) This paper chose only one consulting company in Taiwan as the research object although this company is the most representative one, but flaws may appear in this paper due to the characteristics and culture of this company. Future research could extend to other companies in the same industry in order to obtain more convincing results. (2) This paper used only T test and one-way ANOVA although the results showed clearly customization evaluation factors but other research methods such as regression analysis are required to further clarify issues for deeper implications. (3) Consultants were the only research object in this paper. Although the opinions and decisions of consultants are definitely effective, the management of consulting companies is the final decision makers. Future research could work on the differentiation between these two parties.

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