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The impacts of establishing enterprise information portals on e-business performance

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Abstract

Purpose – To investigate the relationship between organizational characteristics and enterprise information portal (EIP) adoption, and the relationship between EIP implementation and e-business performance.

Design/methodology/approach – This study uses questionnaire survey method to collect data for statistical analysis.

Findings – The result of analysis shows that: between organizations that have and those that have not adopted EIP, significant differences exist in the maturity and familiarity of information technologies, and firm size; the implementation of EIP in terms of application degree, implementation type, integration ability, and users of EIP, will significantly influence e-business performance; the relationship between the application degree of EIP and e-business performance will be enhanced by higher e-business implementation; the relationship between the implementation type of EIP and e-business performance will be intervened by higher e-business implementation.

Practical implications – Corporations may create great business value by establishing EIP project.

Originality/value – This paper provides a model to understand the relationship between EIP implementation and e-business performance and helps corporations evaluate EIP project.

Keywords Electronic commerce, Business performance

Paper type Research paper

1. Introduction

The rapid developments of internet and information technology (IT) has not only provided great growth opportunities, but also shaped the era of digital economy and changed the way the enterprise operates (Wang, 2001). The US Census Bureau's e-business steering committee divides the "electronic economy" into three layers: e-business infrastructure; e-business ("any process that a business organization conducts over computer-mediated network channels"); and e-commerce ("any transaction completed over a computer-mediated network that involves the transfer of ownership or rights to use goods or services") (Mesenbourg, 1999).

As Gerstner (2000) indicated, "Today, e-business is just Business – real business". Thus it can be seen e-business will play an important role in digital economy to enhance competitive advantages (Lai *et al.*, 2001; Soliman and Youssef, 2003).

Owing to technology advances and the wide dissemination of information, many institutions suffer from information overload and require the application of information management to deal with this information chaos in the digital world. Furthermore, organizations increase the requirements of experience and knowledge sharing, system integration ability, and personalization. The enterprise information portal (EIP) provides access – a single point of personalized, online access – to

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business information and knowledge sources, and real-time access to core application and processes.

Recently, industry trend-watchers have forecasted the rise of portal development in corporations. For instance, Gartner Group predicts with 80 percent probability that more than half of all major companies by the end of the year 2001 will implement corporate portals as the primary method for organizing and discovering corporate resources (Detlor, 2000). Likewise, the EIP adoption rate based on a Delphi Group survey of Fortune 500 companies in 1999 is about 65 percent: 35 percent of these companies have implemented a corporate portal and another 30 percent are in the pilot/experimental stage of development (Aneja *et al.*, 2000). Further, Shilakes and Tylman (1998) estimated that the market for portal tools and services would be worth upwards of $14.8 billion by the year 2002. Consequently, EIP is regarded as the most important business information management project of the next decade (Collins, 1999).

Our research focuses on investigating the relationship between organizational characteristics, whether EIP is adopted in the business operations, and the relationship among the function application degree, implementation type, integration ability, and users of EIP and e-business performances. Then, we address the intervening effect of e-business degree and EIP implementation time in how they will affect the relationship of EIP implementation and e-business performance.

2. Related research

2.1 Enterprise information portal

There has been a great interest during the past two years in the emergence of EIP. In sum, an enterprise portal can be defined as a single point of access (SPOA) for the pooling, organizing, interacting, and distributing of organizational knowledge (Aneja *et al.*, 2000; Schroeder, 2000).

Since its development, the terminology related to the EIP has not yet been settled. The terms "corporate portal", "corporate information portal", "business portal", and "enterprise information portal" are all used, sometimes interchangeably as synonyms (Dias, 2001). Cutter Consortium also indicated that EIP is a "fuzzy word" (Chen, 2002).

Shilakes and Tylman (1998) identified EIP as an amalgamation of software applications used to consolidate, manage, analyze and distribute information across and outside of an enterprise and enable companies to unlock internally and externally stored to make informed business decisions. Eckerson (1999) uses another term "business portal" and defines it as an application that provides business users a one-stop shopping for any information object they need inside or outside the corporation. Dias (2001) uses a term "corporate portal", closely related to EIP, and takes technical point of view to identify this corporate portal; this definition requires using metadata and eXtensible Markup Language (XML) to integrate unstructured data to structured data from operational databases, supplying access to corporate information through a personalized interface which is available over the internal hypertext network – the intranet. On the other hand, Murry (1999) stated that portals that focus only on content are inadequate for the corporate market and that "corporate portals must connect us not only with everything we need, but with everyone we need, and provide all the tools we need to work together".

Reynolds and Koulopoulos (2000) identified four phases of web portal development: boolean search; categorized navigation; personalization; and integration of additional

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features providing direct access to other specialized information and commercial worlds.

This web portal evolution impressed the corporate community, which viewed the possibility of using the same technology to manage structure and facilitate the task of accessing the companies' internal information.

Portals have fairly complex structures and features. According to survey results for intelligent enterprise readers, once deployed, EIP resources will be divided among following functions: B2B e-commerce (38 percent); B2E e-commerce (37 percent); and B2C e-commerce (25 percent).

However, their functions and elements are relatively easy to define (Raol *et al.*, 2002). First, from an operational perspective, the strength of corporate portals lies in its ability to provide web-based access to enterprise information, applications and processes. Second, from a functional perspective, portals leverage existing information systems, data stores, networks, workstations, servers, and applications as well as other knowledge bases to give each employee in each corporate site immediate access to an invaluable set of corporate data anytime, anywhere (White, 2000).

Functions and features are fairly difficult to define separately because they may have interrelated macro- and micro-level components. In most corporate portals, features and functions co-exist at the same level because they are still in the developing process. Typically, common functions are the components that provide access to the range of disparate enterprise databases and information resources and the ease with which users can set up personalized access to enterprise and external information resources (White, 2000). In most enterprise portals, these functions may include, but are not limited to, security, network, administrative tools, search, content management, collaboration personalization, extensibility, easy to use, and scalability (Eckerson, 2000).

2.2 E-business

E-business is more than just internet presence or e-commerce transactions; it is a new business design "that emphasizes a finely tuned integration of customer needs, technology and processes" (Kalakota and Robinson, 1999).

Kalakota and Robinson (1999) defined e-business as the complex fusion of business processes, enterprise applications, and organizational structure necessary to create a high-performance business model. E-business includes e-commerce, as well as both front and back-office applications that form the engine of modern business (Kalakota and Robinson, 1999).

E-business is an enterprise with the capability to exchange value (goods, services, money, and knowledge) digitally. It has properly designed business processes for this new way of conducting business. Furthermore, it understands the human performance challenges not only within its organizational boundaries but also for other people in its enterprise network: customers, partners, and suppliers. E-business is a new way of doing business that involves connectivity, transparency, sharing, and integration. It connects the expanded enterprise through a universal digital medium to partners, suppliers, and customers. It requires the integration and alignment of business processes, technology, and people with a continuously evolving e-business strategy (Hackbarth and Kettinger 2000).

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2.3 Organizational characteristics

The organizational characteristics have significant impacts on quality and effectiveness of the planning process of information systems. The planning method of information systems must match the organizational characteristics (Premkumar and King, 1994; Walker and Johnson, 2001; Kao and Decou, 2003). The relationship between organizational characteristics and whether IT is adopted has been emphasized in both empirical and prescriptive studies (Yap, 1990; Grover and Goslar, 1993; Yap and Thong, 1995; Premkumar and King, 1994; Phan, 2002).

Yap and Thong (1995) found that firm size is the most significant discriminator in determining the use of IT. Limitations for the small companies to adopt IT include poor resources, financial constraints, lack of specialists, and high sensibility to outside pressures. They also demonstrated that competition in the environment and information intensity does not significantly influence the adoption of IT by small businesses. Grover and Goslar (1993) found that organizational structure and centralization influence organizations to adopt telecommunication technology.

According to prior research, this paper selects seven organizational characteristics from related research including firm size, information intensity, formalization, centralization, the maturity and familiarity of information technologies, industry type, and competitiveness of environment.

3. Research method

3.1 Research model

The objectives of this study were to understand the relationship between organizational characteristics, whether EIP is adopted into e-business operations, and the impact of e-business performances when implementing EIP. According to the research objectives and related researches and literatures, two phases of the research model were shown in Figures 1 and 2.

In research model 1, we investigate the correlation between organizational characteristics and the strategic decision to implement the EIP. For independent variables, we induced seven organizational characteristics from related research, including firm size, information intensity, formalization, centralization, the maturity and familiarity of information technologies, industry type, and competitiveness of environment. The dependent variable, the adoption, can be divided into two groups: adoption and non-adoption.

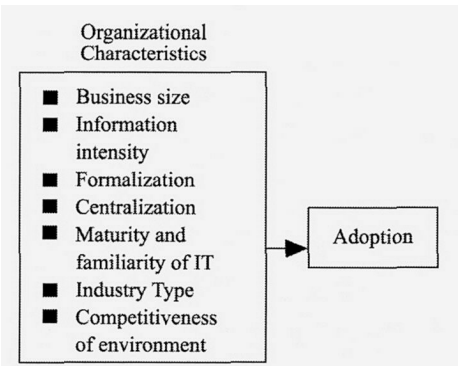

Figure 1.
Research model 1

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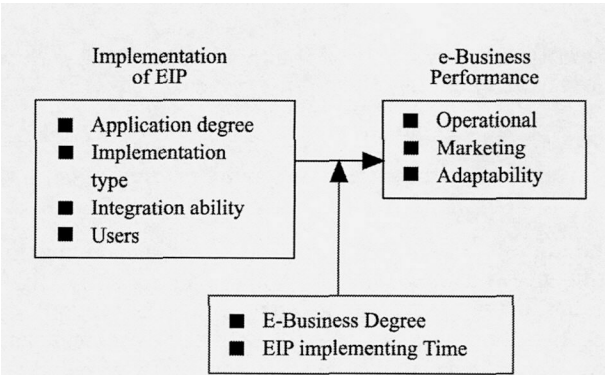

Figure 2.
Research model 2

In research model 2, we investigate the relationship among the implementation of EIP and e-business performances. Then, we address the e-business degree and implementation time in intervening the influence of the impact of establishing EIP and e-business performance. There are four directions to probe into the implementation of EIP including application degree, implementation type, integration ability, and users of EIP. In respect to e-business performance, we induced three different indicators from related literatures as means of measurement: operational performance, marketing performance, and adaptability performance. For intervening variables, the implementation time of EIP is different for each corporation; the time period may influence the e-business performance. In addition, EIP is an important part of e-business. Therefore, the e-business degree may influence the e-business performance.

3.2 Hypotheses

The relationship between organizational characteristics and whether IT is adopted has been emphasized in both empirical and prescriptive studies (Yap, 1990; Grover and Goslar, 1993; Yap and Thong, 1995; Premkumar and King, 1994). According to the results of prior researches, organizational characteristics do significantly influence the adoption of IT. The organizational characteristics have significant impacts on quality and effectiveness of the planning process of information systems. The planning method of information systems must match the organizational characteristics (Premkumar and King, 1994). This leads to *H1*.

H1. Organizational characteristics will significantly influence the adoption of EIP.

We induced seven organizational characteristics from related research, including firm size, information intensity, formalization, centralization, the maturity and familiarity of information technologies, industry type, and competitiveness of environment. This leads to the following additional hypotheses:

H1a. Firm size will significantly influence the adoption of EIP.

H1b. Information intensity will significantly influence the adoption of EIP.

H1c. Formalization will significantly influence the adoption of EIP.

H1d. Centralization will significantly influence the adoption of EIP.

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H1e. The maturity and familiarity of information technologies will significantly influence the adoption of EIP.

H1f. Industry type will significantly influence the adoption of EIP.

H1g. Competitiveness of environment will significantly influence the adoption of EIP.

According to the survey results by Chen (2002), application functions of EIP do significantly influence business performance. Consequently the stronger the application function ability of corporations, the easier it is for companies to achieve the requirements of increase ROI, enhance competitive advantages that the corporate needs. Essentially, the stronger application function ability of EIP, the more brilliant the e-business performance. This leads to *H2*.

H2. The application ability of EIP will significantly influence the e-business performance.

H2a. The application ability of EIP will significantly influence the operational performance.

H2b. The application ability of EIP will significantly influence the marketing performance.

H2c. The application ability of EIP will significantly influence the adaptability performance.

The EIP product market is relatively young because it was only started in early 1998 (Raol *et al.*, 2002). The market is very immature and is crowded with vendors offering different capabilities. Each product available on the EIP product market, when compared to its competitors, has its own characteristics, distinct structure, or additional components considered to be competitive (Dias, 2001).

White (2000) points out the two functions of EIP, decision-making support and collaborative processing, classifying EIP into four main categories: "intranet portal", "collaborative portal", "decision processing portal", "and e-business portal". The four categories are the phases of EIP evolvement. An EIP begins to add real business value to an organization when it supports access to information managed by decision-processing systems. In other words, in the phase of decision process portal, EIP starts to add real business value to the corporation. And in the phase of e-business portal, EIP can contribute the hugest business value to the corporation. For this reason, different implementation types of EIP may influence the business performance. This leads to *H3*.

H3. The implementation type of EIP will significantly influence the e-business performance.

H3a. The implementation type of EIP will significantly influence the operational performance.

H3b. The implementation type of EIP will significantly influence the marketing performance.

H3c. The implementation type of EIP will significantly influence the adaptability performance.

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Application integration services enable EIP to provide users with a centralized, unified, and consistent environment for interactions with all applications (Hummingbird Ltd, 2000). As described by Shilakes and Tylman (1998), central to the concept of EIP is the assumption that disparate applications (content management, business intelligence, data warehouses/marts and data management) will:

(1) access other internal and external sources of information and data;

(2) exchange information (bi-directional); and

(3) use that information within the application for processing and analysis.

In other words, these applications must be integrated with each other and to other external systems. The biggest selling point of EIP is its ability to present information from diverse sources through a common interface. Consequently, the most visible integration requirement for EIP is to provide an integrated web interface-based view of all (whether data store, content, or application server-based) of the information resources of the enterprise and external information resources that are the target of the EIP application (Joseph, 2001). This leads to *H4*.

H4. The integration ability of EIP will significantly influence the e-business performance.

H4a. The integration ability of EIP will significantly influence the operational performance.

H4b. The integration ability of EIP will significantly influence the marketing performance.

H4c. The integration ability of EIP will significantly influence the adaptability performance.

Besides employees, the users of EIP include suppliers/partners and customers. EIP can drive business advantages through real time collaboration among these parties. EIP users can consist of external users such as suppliers, partners, and customers. It will promote business volume and operational performance. Therefore, the different users of EIP may influence the e-business performance. This leads to *H5*.

H5. The users of EIP will significantly influence the e-business performance.

H5a. The users of EIP will significantly influence the operational performance.

H5b. The users of EIP will significantly influence the marketing performance.

H5c. The users of EIP will significantly influence the adaptability performance.

E-business degree of organization is also one of the factors that may affect the e-business performance. The successful implementation of the EIP is not only based on the business strategies that are tailored for the company, but the corporation must have also implemented e-business at a satisfactory level. If the corporation still relies on traditional paper work, the competitiveness of the corporation will be decreased due to lack of informatics and digital technology. Furthermore, it will create a barrier in becoming one of the users of the prosperous internet, and it will be unable to gain all

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the benefits that the EIP can bring as a result. We therefore, propose the following hypotheses.

H6. The relationship between the implementation of EIP and e-business performance will be intervened by e-business degree.

H6a. The relationship between the application degree of EIP and e-business performance will be intervened by e-business degree.

H6b. The relationship between the implementation type of EIP and e-business performance will be intervened by e-business degree.

H6c. The relationship between the integration ability of EIP and e-business performance will be intervened by e-business degree.

H6d. The relationship between the users of EIP and e-business performance will be intervened by e-business degree.

Additionally, the implementation time of EIP is different for each organization, and the length of time will affect the performance. Based on the result of prior research, Chen (2001) mentioned that the implementation time of IS has a significant impact on business performance. In other words, the longer the implementation time of a system, the better the business performance will be generated. We therefore, propose the following hypotheses.

H7. The relationship between the implementation of EIP and e-business performance will be intervened by the implementation time of EIP.

H7a. The relationship between the application degree of EIP and e-business performance will be intervened by the implementation time of EIP.

H7b. The relationship between the implementation type of EIP and e-business performance will be intervened by the implementation time of EIP.

H7c. The relationship between the integration ability of EIP and e-business performance will be intervened by the implementation time of EIP.

H7d. The relationship between the users of EIP and e-business performance will be intervened by the implementation time of EIP.

3.3 Variables, measurement, and sampling

The variables associated with the constructs in the research models and their measurements are summarized in Table I.

The research data were collected via questionnaire survey. The sample frame for this survey was constructed using stratified disproportionate random sampling from the list of Taiwan Top 1,000 companies furnished by *Common Wealth Magazine*. The survey subjects include companies in finance, service, and manufacturing industries. We selected 100, 300, and 600 firms from the three industries, respectively, by random sampling. The key informants were the IT senior managers of the companies.

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Construct	Variable	Measurement
Organizational characteristics	Firm size	Number of employee, sales volume, total assets
	Industry type	Manufacture, service, finance
	Information intensity, formalization, centralization, the maturity and familiarities of IT, competitive environment	five point Likert scale, 1: very disagree, 5: very agree
Implementation of EIP		
Application degree	Content management, search engine, BI tools, collaboration, personalization, security	five point Likert scale, 1: very disagree, 5: very agree
Implementation type	Data presentation, collaboration, personalization, decision support, transaction, integration	five point Likert scale, 1: very disagree, 5: very agree
Integration ability	Integration of documents, web data, financial system, consumers' data, CRM	five point Likert scale, 1: very disagree, 5: very agree
Users	Users	Category scale: employees, partners/suppliers, customers
E-business degree	E-business strategy, across function interaction, internet application, internet infrastructure	five point Likert scale, 1: very disagree, 5: very agree
EIP implementation time	EIP implementation time	Months
E-business performances	Operational performance, marketing performance, adaptability performance	5 point Likert scale, 1: very disagree, 5: very agree

Table I. Variables and measurement

4. Analysis and results

4.1 Data collection

Thousand questionnaires were mailed out in December 2002. A month after the first round of mailing, reminders and follow-up questionnaires were mailed out to 883 non-responding firms. One hundred and ninety two were returned and 181 had complete data usable for analysis, yielding an effective response rate of 18.1 percent.

Among 181 respondents, 52 respondents indicated that they had completed an EIP deployment and 35 respondents were developing. They had implemented EIP, so we classify the 87 (48 percent) respondents into adoption group. Another 50 respondents were still in the planning stage of EIP project, and 44 respondents have not yet planned to establish. We classify the 94 (52 percent) respondents into non-adoption group.

4.2 Stability test

The non-response bias was tested in two ways. First, early and late respondents were compared using four descriptive variables (industry type, turnover, total assets and employee numbers). The results of chi-square test indicated no significant differences in these four variables between early and late respondents (p-values are 0.102, 0.205, 0.586, 0.468). Thus, there was no evidence of obvious response bias in the sample.

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Second, population and sample was compared using three descriptive variables (industry type, total assets and employee numbers). The chi-square test results also provide evidence that there was no response bias problem in the sample (p-values are 0.1845, 0.429, 0.072).

4.3 Validity and reliability test

Content validity is the determination of whether the scale items used in the survey cover sufficient contents of the underlying constructs. Firstly, it was established through a careful assessment of the literature. Secondly, the pre-test is done by three EMBA students, and some refinements are done according to their suggestions. Finally, at each stage, the questionnaire is iteratively revised by experts in the MIS field.

Those items to represent a construct as a one-phase measurement model or a dimension as a two-phase measurement model must have the unidimensionality to make sure the total score is valid to measure a single concept. The items without the convergent validity should be eliminated, according to factor loadings.

In this study, we used exploratory factor analysis (EFA) to test the construct validity of the measures and evaluate the factor loading. Principal component analysis with a varimax rotation technique was conducted on all items and no restrictions were placed on the number of components to be extracted. The principal components were extracted on the basis of the "eigenvalues greater than 1" heuristic. In determining the appropriate minimum loadings required, loadings greater than 0.30 are considered significant; loadings of 0.40 are considered more significant; and loadings of 0.50 or greater are considered to be very significant. To assure the convergent validity of the scales used in this study, variables were eliminated if the factor loading was below 0.50.

Both the Bartlett test of sphericity, a statistical test for the presence of correlation, and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy are to determine the appropriateness of the factor analyses. Table II shows the KMO measure of sampling adequacy are more than 0.725, with accepted level above 0.5, and the Bartlett test of sphericity indicated significant differences in each construct, with p-value less than 0.05. Based on these statistics, the model is statistically significant and further analysis could be conducted.

Cronbach's coefficient α is a widely used measure of scale reliability. Generally, a scale is reliable if α value is 0.7 or higher. Reliability tests were performed through the

Construct	KMO measure of sampling adequacy	Bartlett test of sphericity Approx. chi-square	p
Organizational characteristics	0.725	1488.760	0.000*
Application ability	0.875	401.999	0.000*
Implementation feature	0.900	1691.983	0.000*
Integration degree	0.861	592.938	0.000*
E-business degree	0.891	2088.584	0.000*
Operational performance	0.884	661.550	0.000*
Marketing performance	0.725	336.933	0.000*
Adaptability performance	0.844	591.508	0.000*

Table II.
KMO and Bartlett test of sphericity

Note: *$p < 0.05$

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calculation of Cronbach's α for each construct. Besides the construct of information sharing whose α value 0.6933 is slightly less then 0.7, others' α value ranged from 0.7067 to 0.9468. Consequently, the result indicates proper internal consistency of the scales. We also calculated the correlation coefficient of different scales and found that all constructs' correlation coefficients are smaller than the constructs' Cronbach's α values. This result means that our scales have good discriminant validity.

4.4 Hypothesis testing

4.4.1 The relationship between EIP adoption and organizational characteristics. Among the variables of organizational characteristics used in the study, only the industry type is nominal data, so we use chi-square test to test the hypothesis. Others are tested by one-way ANOVA.

ANOVA requires the test for homogeneity of variance first. We computed the Levene test for homogeneity of variance. As shown in Table III, the results are not significant in all variables of organizational characteristics. This is evidence that the assumption of homogeneity of variance has not been violated.

The result of the one-way ANOVA and chi-square test indicates that between those organizations that have and those that have not adopted EIP, there are significant differences in the "firm size" and "maturity and familiarity of information technologies" ($p < 0.05$). Thus, *H1a* and *H1e* are supported. In addition, as shown in Table III, the relationship between other organizational characteristics included "information intensity", "formalization", "centralization", "industry type", and "competitiveness of environment" and the adoption of EIP was not significant. Therefore, *H1b*, *H1c*, *H1d*, *H1f*, *H1g* are not supported.

Moreover, in order to find the organizational characteristic that can mostly explain why corporations adopted the EIP technology, we used stepwise discriminate analysis to test. Table IV shows, in the sequence of importance, the variable of organization

Organizational characteristic	Levene (p)	Method	Adoption of EIP F (χ^2)	p	Result
Firm size	2.470 (0.118)	ANOVA	7.295	0.008*	Supported
Information intensity	1.409 (0.237)	ANOVA	0.000	0.983	Not supported
Formalization	0.481 (0.489)	ANOVA	0.411	0.522	Not supported
Centralization	0.485 (0.457)	ANOVA	0.019	0.892	Not supported
Maturity and familiarity of IT	2.655 (0.105)	ANOVA	21.061	0.000*	Supported
Competitiveness of environment	0.045 (0.832)	ANOVA	0.496	0.482	Not supported
Industry type	–	Chi-square	(2.781)	0.245	Not supported

Note: *$p < 0.05$

Table III.
The relationship between organizational characteristics and the adoption of EIP

Order	Organizational characteristic	F	Wilk's lambda	Standardized canonical discrimination function coefficient
1	Maturity and familiarity of IT	21.061*	0.895	0.853
2	Firm size	12.389*	0.878	0.399

Note: *$p < 0.05$

Table IV.
The stepwise discriminant analysis of organizational characteristics

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characteristics that can explain why corporate adopted EIP is associated with "maturity and familiarity of information technologies" and "firm size".

4.4.2 The relationship between EIP implementation and e-business performance. This study divides the application degree into three categories: high, medium, and low based on the average score of the items, then analyzes its relationship with e-business, operational, marketing, and adaptability performance by ANOVA. It can be seen from Table V that the *H2* is supported for all performance indices.

Because we are forced to divide application degree into three groups, it may thus reduce or enlarge the variability of application degree. This study tests the hypothesis again to ensure the result by stepwise regression analysis. As show in Table VI, the result is the same as ANOVA. Application degree of EIP does significantly influence the e-business performance as well as three sub-construct of e-business performance including operational, marketing, and adaptability performance.

In order to classify EIP implementation into several types, this study employed the factor analysis according to its feature. Responses to the 17-items scales were analyzed by using a principal component analysis with a varimax rotation through EFA. The result extracted three factors of implementation features and they were named as follows: information application, information presentation and information sharing. In all, the factor loading is greater than 0.5 and accumulated percentage of variance is equal to 62.198 percent.

To test *H3*, we grouped the respondents by conducting the cluster analysis on the score data of the feature factors, and then used the ANOVA to check if the average scores of the implementation features of different group of respondents are significantly different. We used the Ward's method, one of the hierarchical cluster methods, for the cluster analysis. The respondents were divided into three groups: 33 (18.7 percent) low gradation EIP; 126 (70 percent) developing EIP; and 21 (11.5 percent) omnibearing EIP.

They were so called because of the difference in their perceptions of the implementation feature factors.

Table V.
The ANOVA result of application degree and e-business performance

Variables	Sum of squares	df	Mean square	F	p
E-business performance	12.971	2	6.486	14.800	0.000*
Operational performance	13.690	2	6.845	14.832	0.000*
Marketing performance	9.959	2	4.979	6.540	0.002*
Adaptability performance	15.715	2	7.858	15.956	0.000*

Note: $*p < 0.05$

Table VI.
Regression analysis of application degree and e-business performance

Variables	Samples	R^2	β	t	p
E-business performance	181	0.156	0.395	5.752	0.000*
Operational performance	181	0.154	0.393	5.713	0.000*
Marketing performance	181	0.082	0.286	3.995	0.000*
Adaptability performance	181	0.155	0.394	5.737	0.000*

Note: $*p < 0.05$

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Table VII shows the ANOVA results of the scores of performance indices of the three groups of respondents. It can be seen from the table that *H3* is supported for the e-business, operational, marketing, and adaptability performance. Therefore, the relationship between implementation type of EIP and e-business performance is significant. Omnibearing EIP type has higher e-business performance than other two types of EIP in evidence.

Likewise, this study grouped integration ability of EIP into three categories: high, medium, and low based on the average score of the items, then analyzed their relationship with e-business, operational, marketing, and adaptability performance by ANOVA. It can be seen from Table VIII that *H4* is supported for all performance indices.

Because we are forced to divide integration ability into three groups, it may reduce or enlarge the variability of grouped integration ability. This study tested the hypothesis again to ensure the result by stepwise regression analysis. Through Table IX, the result of the correlation of integration ability and e-business performance is significant, as well.

Based on the data of 52 respondents that had completed an EIP deployment, the users of EIP were divided into employees, partners/suppliers, and customers. As shown in Table X, *H5* is not supported. Hence, whatever the user type, the impacts of implementing EIP on e-business performance is not significant.

Variables	Sum of Squares	df	Mean Square	F	p	Scheffe
E-business performance	14.628	2	7.814	14.628	0.000*	A3 > A2, A1
Operation performance	14.625	2	7.312	14.625	0.000*	A3 > A2, A1
Marketing performance	18.480	2	9.240	18.480	0.000*	A3 > A2, A1
Adaptability performance	14.569	2	7.284	14.589	0.000*	A3 > A2, A1

Note: A1: low gradation EIP; A2: developing EIP; A3: omnibearing EIP; *$p < 0.05$

Table VII.
The ANOVA result of implementation type and e-business performance

Variables	Sum of squares	df	Mean square	F	p
E-business performance	16.702	2	8.351	20.014	0.000*
Operational performance	16.460	2	8.230	18.456	0.000*
Marketing performance	14.783	2	7.391	10.066	0.000*
Adaptability performance	19.011	2	9.505	20.056	0.000*

Note: *$p < 0.05$

Table VIII.
The ANOVA result of integration ability and e-business performance

Variables	Samples	R^2	β	t	p
E-business performance	181	0.251	0.501	7.739	0.000*
Operational performance	181	0.243	0.493	7.589	0.000*
Marketing performance	181	0.131	0.361	5.185	0.000*
Adaptability performance	181	0.247	0.497	7.665	0.000*

Note: *$p < 0.05$

Table IX.
Regression analysis of application degree and e-business performance

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4.4.3 The intervening effect of e-business degree. To check if the relationship between the implementation of EIP and e-business performance is intervened by e-business degree, this study divided e-business degree as high, medium, and low based on the average score of the items. We test *H6* by two-way ANOVA. While the result is significant, we then go a step further to check if the intervention is to enhance or weaken the impact by drawing a graph.

From Table XI, we can see that the relationship between the application degree of EIP and e-business performance is intervened by e-business degree. *H6a* is supported. Figure 3 shows the interaction effort of application degree and e-business degree. Regardless of the level of application degree, a high e-business degree has higher e-business performance than others. For this reason, we can infer that the intervention is enhancing the relationship between the application degree of EIP and e-business performance. Furthermore, the shape of curve of low e-business degree is not in common with others, especially in medium application degree. This is because in the

Table X.
The ANOVA result of users of EIP and e-business performance

Variables	Sum of squares	df	Mean square	*F*	*p*
E-business performance	1.480	2	0.627	1.229	0.235
Operational performance	1.928	2	0.803	1.232	0.226
Marketing performance	1.918	2	0.757	0.876	0.325
Adaptability performance	1.501	2	0.794	1.530	0.238

Table XI.
The interaction between EIP Application degree and e-business degree

Source of variance	Variables	Sum of squares	Mean square	*F*	*p*
Application degree * e-business degree	E-business performance	7.169	1.792	5.113	0.001*
	Operational performance	8.909	2.227	5.722	0.000*
	Marketing performance	7.218	1.805	2.737	0.030*
	Adaptability performance	6.508	1.642	4.061	0.004*

Note: $*p < 0.05$

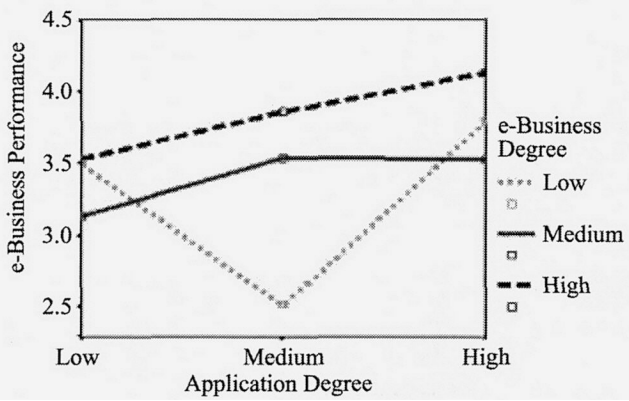

Figure 3.
EIP application degree and e-business degree interaction on e-business performance

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group of medium application degree and low e-business degree, among a total eight respondents only one corporation was developing EIP. Three corporations were still in the planning stage of EIP project, and other four respondents have not yet to plan. This configuration leads to the bias of the result.

To improve the accuracy of the result, we test the hypothesis again based on 52 samples that had completed an EIP deployment. It can be seen from Table XII that the *H6a* is rejected as well. As shown in Figure 4, higher e-business degree has higher e-business performance than others consistently. The shape of curve of low e-business degree is also different. The bias is formed on the assumptions that a low application degree only has three samples and high application degree just has one sample, in low e-business degree group.

Likewise, by two-way ANOVA, we found that the relationship between implementation type of EIP and e-business performance will be intervened by e-business degree ($F = 2.549$, $p < 0.05$), as shown in Table XIII. That is, *H6b* is also supported. According to the graph of Figure 5, the interaction of EIP implementation type and e-business degree on e-business performance, with the exception of omnibearing type of EIP, higher e-business degree has higher e-business performance approximately. On omnibearing type of EIP, lower e-business degree corporations have highest e-business performance than higher e-business degree corporations instead. This is because this group has only one sample.

In order to validate the correctness of the result, we test the hypothesis again based on 52 samples that had completed an EIP deployment. The result of analysis as shown

Source of variance	Variables	Sum of squares	Mean square	F	p
Application degree * e-business degree	E-business performance	2.424	0.808	2.942	0.043*
	Operational performance	5.295	1.765	5.299	0.003*
	Marketing performance	4.307	1.436	2.636	0.061
	Adaptability performance	0.332	0.111	0.279	0.840

Note: *$p < 0.05$

Table XII.
The interaction between EIP application degree and e-business degree ($n = 52$)

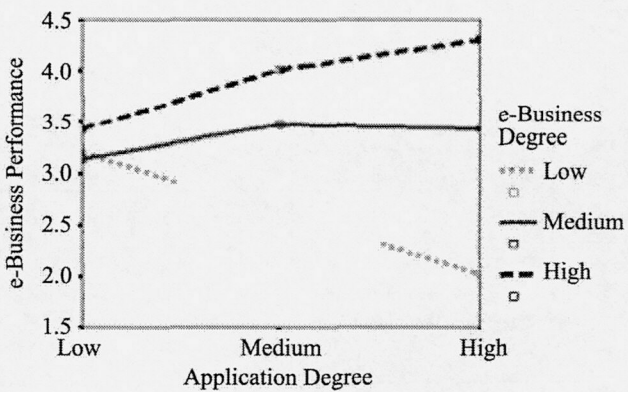

Figure 4.
EIP application degree and e-business degree interaction on e-business performance ($n = 52$)

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in Table XIV supports *H6b*, as well. Figure 6 shows, that the higher e-business degree has higher e-business performance in any implementation types. This confirms that the relationship between EIP implementation type and e-business performance will be intervened by e-business degree.

According to the result shown in Table XV, *H6c* is not totally supported on 181 samples. The analysis of 52 samples has the same result. Hence, the relationship between the integration ability of EIP and e-business performance will not be intervened by e-business degree.

Likewise, for the 52 EIP implemented companies, the relationship between users of EIP and e-business performance will not be significantly influenced by e-business

Table XIII.
The interaction between EIP implementation type and e-business degree

Source of variance	Variables	Sum of squares	Mean square	F	p
Implementation type * e-business degree	E-business performance	3.469	0.867	2.549	0.041*
	Operational performance	3.908	0.977	2.446	0.048*
	Marketing performance	5.078	1.269	2.099	0.083
	Adaptability performance	2.973	0.743	1.812	0.129

Note: $*p < 0.05$

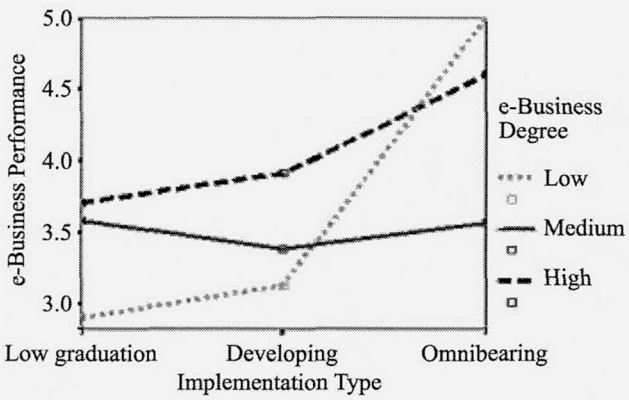

Figure 5.
EIP implementation type and e-business degree interaction on e-business performance

Table XIV.
The interaction between EIP implementation type and e-business degree ($n = 52$)

Source of variance	Variables	Sum of squares	Mean square	F	p
Implementation type * e-business degree	E-business performance	2.268	0.756	2.984	0.042*
	Operational performance	5.868	1.956	6.323	0.001*
	Marketing performance	1.634	0.545	1.068	0.372
	Adaptability performance	3.445	1.148	3.525	0.023*

Note: $*p < 0.05$

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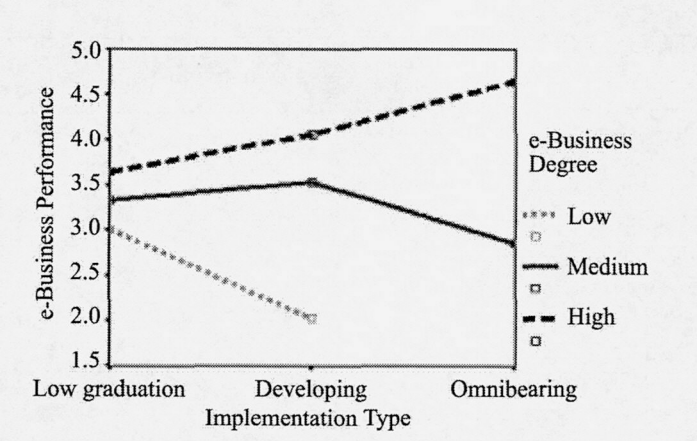

Figure 6.
EIP implementation type and e-business degree interaction on e-business performance

degree ($F = 0.658$, $p = 0.623 > 0.05$), as can be seen from Table XVI. That is, *H6* is not supported.

4.4.4 The intervening variable of implementation time. To test if the relationship between the implementation of EIP and e-business performance will be intervened by implementation time of EIP, this study divided implementation time as long, medium, and short based on the average score of the items. We test the hypothesis by two-way ANOVA. If the result is significant, we then proceed a step further to confirm that the intervention is to enhance or weaken the relationship by drawing the data on a graph.

According to the result shown in Table XVII, the correlation among e-business performance and every construct of EIP implementation will not be significantly influenced by implementation time. In other words, *H7* is not supported for all the constructs of EIP implementation.

5. Conclusions

The result of our study shows that:

Source of variance	Variables	Sum of squares	Mean square	F	p
Integration ability * e-business degree	E-business performance	1.951	0.488	1.335	0.259
	Operational performance	3.650	0.763	1.863	0.119
	Marketing performance	1.941	0.485	0.720	0.579
	Adaptability performance	2.240	0.560	1.348	0.254

Table XV.
The interaction between integration ability and e-business degree

Source of variance	Variables	Sum of squares	Mean square	F	p
Users * e-business degree	E-business performance	0.737	0.184	0.658	0.623
	Operational performance	0.703	0.176	0.384	0.820
	Marketing performance	1.737	0.434	0.839	0.504
	Adaptability performance	0.377	0.094	0.277	0.892

Table XVI.
The interaction between users of EIP and e-business degree

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Source of variance	Variables	Sum of squares	Mean square	F	p
Application degree * EIP implementation time	E-business performance	2.375	0.594	1.499	0.219
	Operational performance	1.972	0.493	0.961	0.439
	Marketing performance	5.112	1.278	1.788	0.149
	Adaptability performance	1.978	0.495	1.113	0.363
Implementation type * EIP implementation time	E-business performance	0.253	0.063	0.154	0.960
	Operational performance	0.468	0.117	0.232	0.919
	Marketing performance	0.527	0.132	0.168	0.954
	Adaptability performance	0.493	0.123	0.264	0.899
Integration ability * EIP implementation time	E-business performance	0.615	0.154	0.404	0.805
	Operational performance	0.377	0.094	0.188	0.944
	Marketing performance	1.759	0.440	0.605	0.661
	Adaptability performance	1.058	0.265	0.611	0.657
Users * EIP implementation time	E-business performance	0.582	0.146	0.285	0.887
	Operational performance	0.568	0.142	0.218	0.928
	Marketing performance	1.963	0.492	0.613	0.654
	Adaptability performance	0.582	0.145	0.272	0.895

Table XVII.
The intervening effect of EIP implementation time

(1) Between organizations that have and those that have not adopted EIP, there are significant differences in the maturity and familiarity of information technologies, and firm size.

(2) In the way of EIP implementation, the relationship among function application degree, implementation type, integration ability, and e-business performance are also significant.

(3) The relationship between application degree of EIP and e-business performance will be enhanced by higher e-business degree.

(4) The relationship between implementation type of EIP and e-business performance will be intervened by e-business degree.

(5) The implementation time of EIP has no significant impact on the relationship between EIP implementation and e-business performance.

Several conclusions can be derived. First, the most important reason corporations adopt EIP is "the maturity and familiarity of IT". Thus we believe that EIP is a new concept of information management, the company with more IT implementation experiences is more likely to accept the new application system. Secondly, "firm size" is another factor that influences a corporation's EIP adoption. In general, the larger size of corporation, the requirement of information is more complex and the cost of adopting new IT will be relatively economic. Accordingly, the larger corporation may be more likely to implement the EIP project. Third, according to the result, more than half corporations implement EIPs since last two years. Thus it can be seen that EIP is an available technology and the current trend of information management and e-business project. We divided EIP into three types: "low gradation EIP", "developing EIP", "omnibearing EIP". Only 10 percent corporations belong to omnibearing EIP,

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70 percent corporations belong to developing EIP. It shows that the implementation of EIP is still immature. Last, the implementation of EIP can enhance the e-business performance. Therefore, we suggest that corporations create the greatest business value by establishing EIP project. And if the corporations prepare to establish e-business, EIP is an effective and useful application.

The most important feature of EIP is its ease of use and the users increasing familiarity of the internet environment. For users, EIP has more usability than other e-business project. For corporations, the difficulty of training users in EIP is lower than other e-business performance.

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