

# The Analysis of Critical Factors of E-Learning System for E-Business<sup>†</sup>

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## Abstract

Many factors such as barriers, reasons, vendor consideration, success factors and challenges play important roles in implementing electronic-learning systems for e-business. In this paper, a questionnaire is used to collect respondents' attitudes toward those factors, and the result is analyzed.

The result of chi-square test indicates that the respondents who have e-learning systems in their organizations are mostly from industries, and for those who have not tend to emphasize more on "cost and unawareness" which scored under 0.4 (i.e. low internal consistency) in reliability. However, the variance of the respondents' attitudes toward the remaining six factors is not large.

**Keywords: e-Learning, e-Business, barriers, reasons for implementation, vendor consideration, success factors, challenge factors.**

## 1. Introduction<sup>†</sup>

Problems may be encountered when implementing e-Learning systems for e-business; however if barriers are known in advance, problems are easier to be solved. In addition, reasons for implementation from different stakeholders setup directions to be followed for e-Learning systems. If the expectation of an e-Learning system is known, corporations can be more confident setting up corresponding strategies (see Figure 1) and implementation can be started. Furthermore, suitable vendors can supply satisfactory e-Learning solutions to corporations. Suitable vendors which provide contents, technologies and services help shorten the implementation time, and guarantee a successful e-Learning system for e-business. Success and challenge factors are collected from related articles which suggest actions to be taken for a better implementation.

In sum, it is recommended to analyze the situation of the corporation as well as plan the expectations for e-Learning systems for e-business. Suitable vendors shall be chosen, and lastly success and challenge factors serve as references for their e-Learning systems.

## 2. Purpose

B2B e-Learning systems facilitate enterprises' (i.e. business-to-business) learning mechanisms via the Internet. Some research reports the factors of their implementations. However, the relationships among the responses toward these factors and whether respondents have e-Learning systems in their organizations are seldom observed. Why do corporations need to understand all these critical factors clearly? Because by doing so, corporations save time and avoid spending money on unnecessary places. If corporations know exactly what different stakeholders feel toward these items, the results will be valuable.

This research investigates implementation factors, and provides practical advices. It analyzes the collected data which is from the survey of "critical factors of an e-Learning system for e-business", and tests such as chi-square test, factor analysis and t-test are used to verify whether there are significant differences in respondents who have e-Learning systems in their organizations, and those who have not. Lastly, the differences and new findings are emphasized.

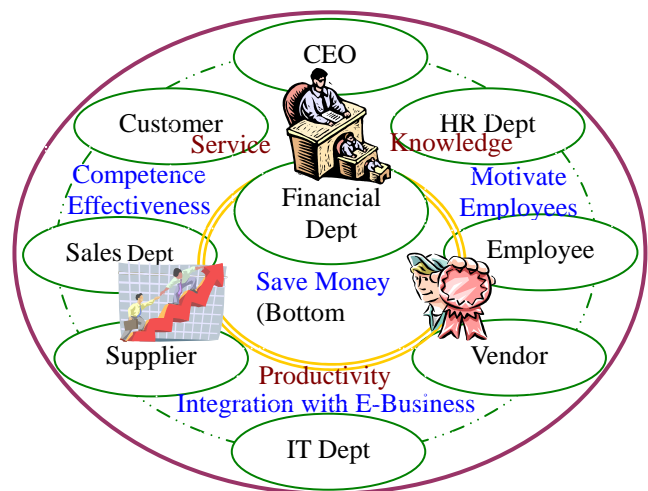


Figure 1 Strategy and Stakeholders

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### 3. Methodology

The research methodology consists of “select critical factors”, “questionnaire design”, “chi-square test”, “factor analysis”, “t-test” and “conclusions” (see Figure 2). The critical factors which collected from the related literatures (see Table 1) are categorized into barriers for e-Learning, reasons for implementation, vendor consideration, success and challenge. A questionnaire which includes nine demographic questions and thirty-eight questions of critical factors is thus designed.

Chi-square test, factor analysis and t-test are conducted to examine if there are significant differences among the responses toward these factors and whether the respondents have e-Learning systems in their organizations. Lastly, the results will be well examined and feedback to the survey for advanced research.

#### 3.1 Designing Questionnaire

Three different types of questionnaires that are web-based, e-mail and hardcopy are provided. The majority of the respondents prefer the web-based questionnaire. The questionnaire consists of six sections. Section 1 identifies the demographic information of the respondents. Questions include gender, age, career, department, position and education. Section 2 focuses on the attitudes of respondents toward the identified “four barriers”. Section 3 emphasizes their attitudes toward “reasons for implementation”.

Section 4 focuses on “vendor consideration”. Section 5 weights their viewpoints toward “success factors”, and lastly section 6 examines the attitudes toward “challenge factors”. These factors are measured using Likert-type scale which ranges from 5 to 1 with the following equivalence, “5”: “strongly agree”; “4”: “agree”; “3”: “neutral”; “2”: “disagree”; “1”: “strongly disagree”.

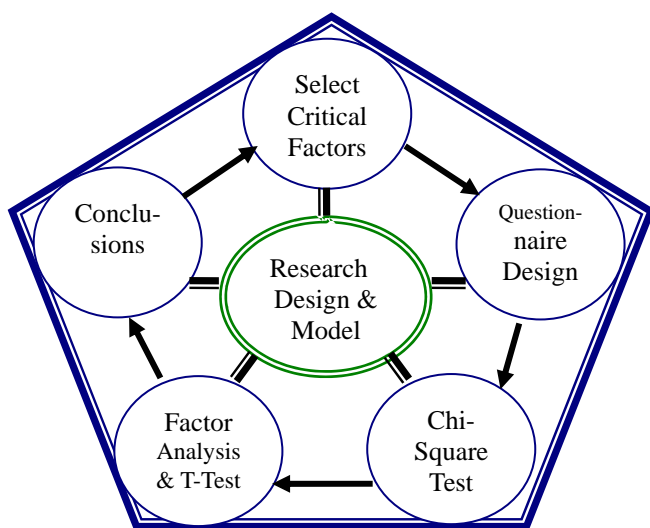


Figure 2 Research Methodology

Table 1 Factors Selected from Related Literatures

Factors / Findings	Source
① Barriers	
<ul style="list-style-type: none"> <li>♦ Budgetary considerations.</li> <li>♦ Immaturity of learning object technologies.</li> <li>♦ Lack of awareness.</li> </ul>	SRI [18] Consulting Business Intelligence
<ul style="list-style-type: none"> <li>♦ Cost versus value.</li> <li>♦ Quality of learning content.</li> <li>♦ Internal resistance to using technology instead of face-to-face learning.</li> </ul>	Forum Corp. [9]
② Reasons	
<ul style="list-style-type: none"> <li>♦ Stay nimble and innovative.</li> <li>♦ Increase customer satisfaction.</li> <li>♦ Stomp the competition.</li> <li>♦ Cut costs.</li> <li>♦ Satisfy the IT department.</li> <li>♦ Improve my skills.</li> <li>♦ Earn more money.</li> </ul>	Lance Dublin and Jay Cross [14]
③ Vendor Consideration	
<ul style="list-style-type: none"> <li>♦ Content, Technology and Service.</li> </ul>	Digital Think [4]
<ul style="list-style-type: none"> <li>♦ Experience.</li> <li>♦ Cost.</li> </ul>	Rosenberg [15]
④ Success	
<ul style="list-style-type: none"> <li>♦ Executive stakeholders.</li> <li>♦ Be the learner.</li> <li>♦ Marketing is your friend.</li> <li>♦ Virtual project teams.</li> <li>♦ Measure everything.</li> </ul>	Cisco [2]
<ul style="list-style-type: none"> <li>♦ Include peer interaction.</li> <li>♦ Provide mentoring.</li> <li>♦ Offer performance feedback.</li> </ul>	David Price & Patrick von Schlag [3]
⑤ Challenge	
<ul style="list-style-type: none"> <li>♦ The first seven items as described in Section 3.2 – Challenge Factors.</li> </ul>	Digital Think [4]
<ul style="list-style-type: none"> <li>♦ Perceived difficulty of using such a system.</li> </ul>	Forum Corp. [9]

### 3.2 List of Factors under Investigation

In this survey, five main items are observed, and each of them contains sub-items. They are listed below:

#### Factors of Four Barriers [9] [18]

- B1 Cost too high
- B2 Technology Immaturity
- B3 Solution Immaturity
- B4 Unawareness

#### Factors of Reasons for Implementation [14]

- R1 Increase Competence
- R2 Stay Innovative
- R3 Support 24 x 7 Training
- R4 Reduce Training Time
- R5 New Training Technology
- R6 Reduce Training Cost
- R7 Increase Revenue
- R8 Decrease Time Spending on Selling
- R9 Flexible Learning
- R10 Win-Win Situation
- R11 Customer On-Line Learning
- R12 Enhance Customer Satisfaction

#### Factors of Vendor Consideration [4] [15]

- V1 Content
- V2 Technology Integration
- V3 Service Quality
- V4 Implementation Experience
- V5 Implementation Cost
- V6 Reputation

#### Success Factors [2] [3]

- S1 Organizational Support
- S2 Virtual Project Teams
- S3 Measure everything
- S4 Include Independent Learners
- S5 Include Peer Interaction
- S6 Provide Mentoring
- S7 Offer Performance Feedback
- S8 Marketing

#### Challenge Factors [4] [9]

- C1 Correct Target Setup
- C2 LMS Configuration
- C3 Tutors and SMEs Integration
- C4 Content Creation
- C5 Multiple Modes of Learning
- C6 Back-End Systems Integration
- C7 Web Infrastructure
- C8 Online Access Capability Training

### 3.3 Conceptual Model

A qualitative phase of this research is conducted to identify possible factors leading to the implementation of an e-Learning system for e-Business [1]. Related literatures on e-Learning systems for e-Business are also reviewed in order to select the factors of interest. Figure 3 depicts the conceptual model of the six factors naming, “Barriers”, “reasons”, “vendor consideration”, “success” and “challenge” and “implementation”.

### 4. Analysis Methods

Information on the attitudes toward critical factors of e-Learning systems for e-business is gathered through survey. Four types of analysis algorithms are used for different factors. Percentage analysis is used for demographic information, and chi-square test examines the relationships among different demographic data as well as whether the respondents have e-Learning systems in their organizations. Factor analysis extracts new factors from those five critical items. New factors are verified using Cronbach’s alpha test to measure the reliabilities. T-test examines the differences among the extracted factors and whether the respondents have e-Learning systems in their organizations.

Excel 2002 and SPSS10.0 are used to compute those results. Detailed explanation and diagrams are provided and discussed in the following sections. Chi-square test contains the row and column variables of the test. Factor analysis and Cronbach’s alpha test are explained in Section 4.2 and 4.3. T-test contains one diagram of the test and grouping variables.

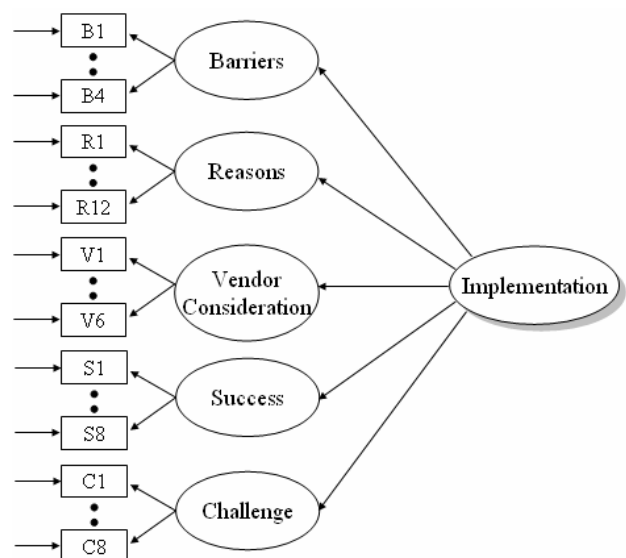


Figure 3 Proposed Models of Factors of Implementing E-Learning Systems for e-Business

#### 4.1 Chi-Square Test

Figure 4 depicts the variables of chi-square test. The relationships among gender, working field, department, role, experience and whether the respondents have e-Learning systems in their organizations are carefully examined.

Gender consists of female and male. Field contains students and the respondents from industries. Department is divided into two groups: Non-IT and IT departments. Role consists of the respondents' experiences on implementation of e-Learning systems. Lastly, experience includes those who have or have not experiences of using e-Learning systems.

#### 4.2 Factor Analysis

According to Foster [12], factor analysis is a technique or a family of techniques which aim to simplify complex sets of data by analyzing the correlations between them. A component or a factor explains the variance in the inter-correlation matrix, and the amount of variance explained is called the eigenvalue.

A factor loading is the correlation of a variable with a factor. If a loading is higher or equal to 0.3, it is frequently taken as meaningful when interpreting a factor. In this paper, principal components analysis is recommended as the method for reducing the number of variables. In order to obtain an orthogonal simple structure rotation, varimax method is used.

#### 4.3 Cronbach's Alpha Test

According to Foster [12], reliability refers to the consistency of the results on different items in a test. Cronbach's alpha is one of the standard ways to express the reliability of a test. The value can be obtained by using SPSS10.0. A reliability coefficient of 0.8 or higher is considered as "acceptable" in most social science applications. The value should not be lower than 0.7. However, tests of personality often have much lower values, partly because personality is a broader construct.

#### 4.4 T-Test

Figure 5 depicts the test and grouping variables of t-test. The differences among "Cost and Unawareness" and "Immaturity" in barriers factor, "Training Effectiveness" and "New Revenues" under reasons for implementation, "Vendor Consideration", "Success", "Challenge" and whether the respondents have e-Learning systems in their organizations are carefully examined.

### 5. Demographic Information

The survey was conducted from May 13<sup>th</sup> to May 27<sup>th</sup>, 2003. There is a total number of 142 respondents, including 56 females (39.44%) and 86 males (60.56%) respectively (Figure 6), agreed to participate in this research. Most of them were from Hsin-Chu Industrial

Science Park and National Chiao Tung University.

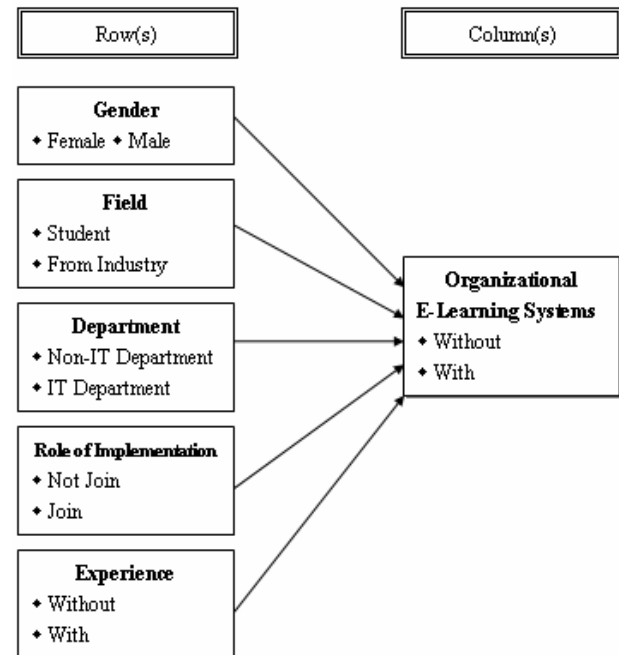


Figure 4 Variables of Chi-Square Test

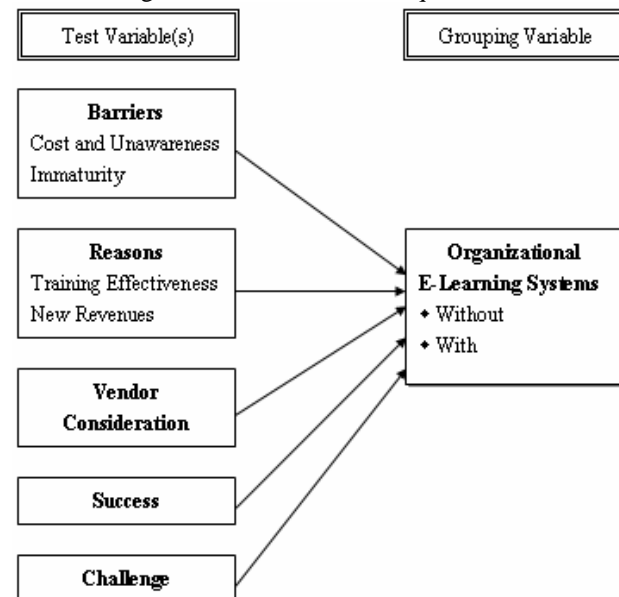


Figure 5 Test and Grouping Variables of T-Test

From figure 7, it clearly illustrates that 29.58% of the respondents were students, and 23.24% of the respondents came from the information technology industries, 16.20% were from electrical and electronics, and 15.4% were from military, government and academic. After the analysis of the departments' bar chart as shown in Figure 8, it is found that 21.13% of the respondents were from the departments of information technology, 11.27% were from management, 10.56% were from technical support, 8.45% were from research & design. 53.52% of the respondents have no e-Learning systems in their organizations (Figure 9). The respondents who have no experiences of implementing e-Learning systems accumulate 72.54% whereas the ones who have account for 27.46% (Figure 10). Lastly, Figure 11 illustrates their experiences of using

e-Learning systems.

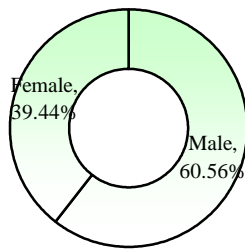


Figure 6 Gender

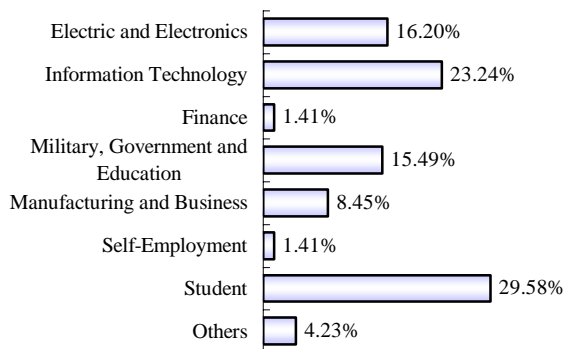


Figure 7 Industry

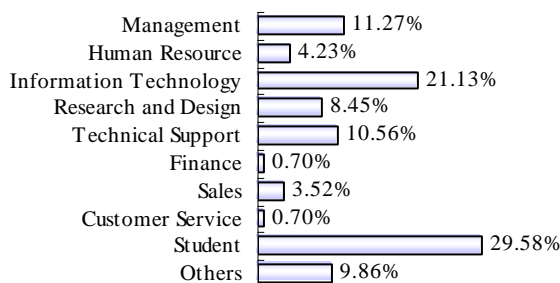


Figure 8 Department

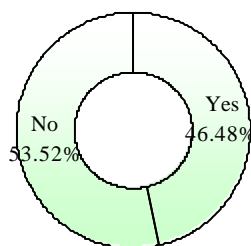


Figure 9 E-Learning Systems Implemented in Organizations

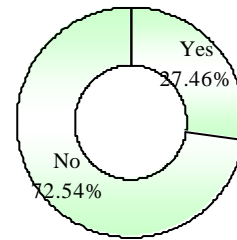


Figure 10 Joining the Implementations of E-Learning Systems

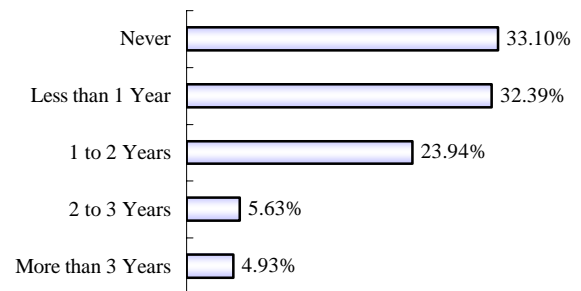


Figure 11 Experiences of Using E-Learning Systems

## 6. Chi-Square Test on Demographic Items

The chi-square test was conducted to test whether there were significant differences among different demographic data as well as whether the respondents have e-Learning systems in their organizations.

### ① Gender

The chi-square value is 1.087 (df=1, n=142) and the p-value is .297 ( $p > 0.05$ ) which means that there is no significant difference. Thus we concluded that whether the respondents have e-Learning systems in their organizations do not have significant difference in gender.

### ② Working Field

The relationship between the respondents' fields and whether they have e-Learning systems in their organizations is shown in Table 2 (Note: ① WO/EL = Without Organizational E-Learning Systems; ② W/EL = with Organizational E-Learning Systems). The chi-square value is 5.78 (df=1, n=142) and the p-value is .016 ( $p < 0.05$ ) which means that there is a significant difference. When comparing the percentages of the two working field groups in Table 2, the percentage of the respondents who are students and have e-Learning systems in their organizations (19.7%) are smaller than those who are from industries (80.3%). It is obvious that the majority of the respondents who have e-Learning systems in their organizations are from industries rather than students. Figure 11 depicts the line chart of field \* organizational e-Learning systems.

Table 2 Field \* Organizational E-Learning Systems Cross Tabulation

Field	WO/ EL	W/ EL	Total
Students	29 (38.2%)	13 (19.7%)	42 (29.6%)
From Industries	47 (61.8%)	53 (80.3%)	100 (70.4%)
Total	76 (100.0%)	66 (100.0%)	142 (100.0%)
Chi-Square Value	X <sup>2</sup> =5.78      df=1      n=142		

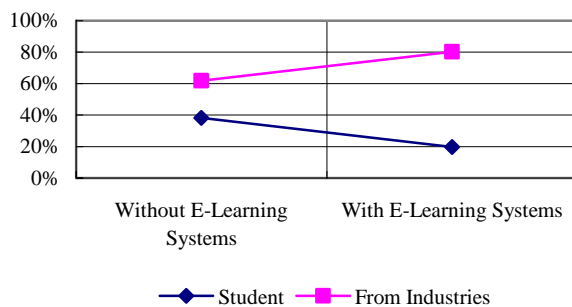


Figure 12 Field \* Organizational E-Learning Systems

### ③ Department

The chi-square value is 2.642 (df=1, n=142) and the p-value is .104 (p>0.05) which means that there is no significant difference. Thus we conclude that whether the respondents have e-Learning systems in their organizations do not have significant difference in non-IT or IT departments.

### ④ Role in Implementation of E-Learning System

The relationship between the respondents' roles in implementations of e-Learning systems and whether they have e-Learning systems in their organizations is shown in Table 3. The chi-square value is 20.033 (df=1, n=142) and the p-value is .000 (p<0.001) which means that there is a significant difference. In order to find out which role group has more respondents, the percentages of the two role groups in Table 3 are compared. When comparing the respondents who have no e-Learning systems in their organizations, it is clear that the respondents who have no experiences of implementing e-Learning systems accumulate greater percentage (88.2%) than those who have (11.8%). However, if comparing the respondents who have e-Learning systems in their organizations, the percentages of respondents who have no experiences of implementing e-Learning systems (54.5%) and who have (45.5%) are very close. Therefore, we conclude that most of the respondents who have no e-Learning systems in their organizations also have no experiences of implementing e-Learning systems. Figure 13 depicts the

line chart of role \* organizational e-Learning systems.

### ⑤ Experiences on Using e-Learning Systems

The relationship among the respondents' experiences on using e-Learning systems and whether they have e-Learning systems in their organizations is shown in Table 4. The chi-square value is 24.506 (df=1, n=142) and the p-value is .000 (p<0.001) which means that there is a significant difference. In order to figure out which experience group has more respondents among those who have e-Learning systems in their organizations, the percentages of the two experience groups are compared. It is obvious that the respondents with experiences show greater percentage (87.9%) than those who do not (12.1%). Thus we conclude that the majority of the respondents who have e-Learning systems in their organizations also have experiences of using e-Learning systems. Figure 14 depicts the line chart of experience \* organizational e-Learning systems.

After the analysis of the chi-square test, we conclude that only working field, role and experience have significant differences between the respondents who have no e-Learning systems in their organizations and those who have. The respondents who have e-Learning systems in their organizations are mostly from industries and have experiences of using e-Learning systems. However, the majority of the respondents who have no e-Learning systems in their organizations also have no experiences of implementing e-Learning systems.

Table 3 Role \* Organizational E-Learning Systems Cross Tabulation

Role	WO/ EL	W/ EL	Total
Not Join	67 (88.2%)	36 (54.5%)	103 (72.5%)
Join	9 (11.8%)	30 (45.5%)	39 (27.5%)
Total	76 (100.0%)	66 (100.0%)	142 (100.0%)
Chi-Square Value	X <sup>2</sup> =20.033      df=1      n=142		

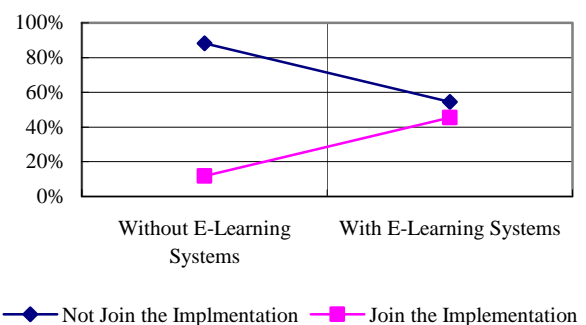


Figure 13 Role \* Organizational E-Learning Systems

Table 4 Experiences \* Organizational E-Learning Systems Cross Tabulation

Experience	WO/ EL	W/ EL	Total
Have no Experience	39 (51.3%)	8 (12.1%)	47 (33.1%)
Have Experience	37 (48.7%)	58 (87.9%)	95 (66.9%)
Total	76 (100.0%)	66 (100.0%)	142 (100.0%)
Chi-Square Value	X <sup>2</sup> =24.506      df=1      n=142		

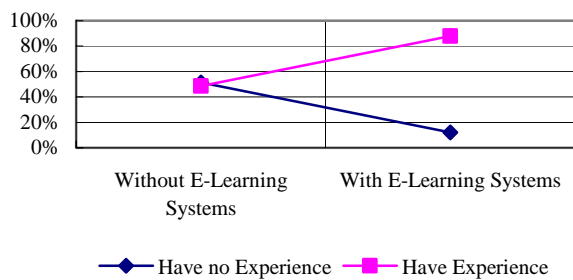


Figure 14 Experiences \* Organizational E-Learning Systems

## 7. Factor Analysis & Cronbach's Alpha Test

The following sections explain the results of factor analysis and Cronbach's alpha test, which are carefully calculated using SPSS version 10.0. It uses the extraction method of principal components and varimax rotation. Additional information regarding the results is also described, such as factor loadings, eigenvalues, percentages of variance and Cronbach's alpha values.

Every factor is labeled a new name which reflects the characteristics of the items it contains. Items are ordered according to their factor loadings (from highest to lowest) and grouped according to factors. However, if the difference between the item's highest and second highest factor loadings is less than 0.15, the item is eliminated.

### 7.1 Analysis of Four Barriers

The factors analysis result of barriers indicates that there are two factors with eigenvalues greater than 1.0. A two-factor solution is suggested after examining the results (see Table 5).

Component one is labeled "Cost and Unawareness" and accounted for 33.372% of the variance. It includes "cost too high" and "unawareness". The reliability (internal consistency) is 0.3702. Component two is labeled "Immaturity" and accounted for 30.031% of the variance. It includes "technology immaturity" and "solution immaturity". The reliability is 0.3848.

Table 5 Factor Analysis of Barriers

Item		Component & Factor Loading	
		1: Cost and Unawareness	2: Immaturity
B1	Cost too High	<b>.811</b>	-5.373E-02
B4	Unawareness	<b>.682</b>	.141
B2	Technology Immaturity	-9.541E-02	<b>.900</b>
B3	Solution Immaturity	.451	<b>.606</b>
Eigenvalue		1.335	1.201
% of Variance		33.372%	30.031%
Cronbach's Alpha		0.3702	0.3848

Note. Boldface indicates highest factor loadings.

Table 6 Factor Analysis of Reasons

Item		Component & Factor Loading	
		1: Training Effectiveness	2: New Revenue
R3	Provide 24 x 7 Full time Training	<b>.834</b>	6.830E-02
R5	New Training Technology	<b>.830</b>	.164
R9	Flexible Learning	<b>.793</b>	.289
R11	Customer On-Line Learning	<b>.782</b>	.132
R4	Reduce Training Time	<b>.757</b>	.228
R1	Increase Competence	<b>.738</b>	.385
R6	Reduce Training Cost	<b>.547</b>	.378
R10*	Win-Win Situation	.538	.431
R8	Decrease Time Spending on Selling	-7.382E-02	<b>.886</b>
R7	Increase Revenue	.248	<b>.672</b>
R2*	Stay Innovative	.464	.550
R12*	Enhance Customer Satisfaction	.428	.507
Eigenvalue		4.796	2.457
% of Variance		39.964%	20.477%
Cronbach's Alpha		0.9033	0.5678

Note. Boldface indicates highest factor loadings.

\* indicates the difference between two factor



loadings is less than 0.15.

## 7.2 Analysis of Reasons for Implementation

The factor analysis result of reasons indicates that there are two factors with eigenvalues greater than 1.0. A two-factor solution is suggested after examining the results (see Table 6).

Component one is labeled “Training Effectiveness” and accounted for 39.964% of the variance. It includes all the sub-items about training. The reliability is 0.9033. Component two is labeled “New Revenues” and accounted for 20.477% of the variance. It includes “decrease time spending on selling” and “increase revenue”. The reliability is 0.5678.

## 7.3 Analysis of Vendor Consideration

The factor analysis result of vendor consideration indicates that there is one factor with eigenvalue greater than 1.0. A one-factor solution is suggested after examining the results (see Table 7).

Component one is labeled “Vendor Consideration” and accounted for 62.289% of the variance. It contains all the items in vendor consideration. The reliability is 0.8658.

## 7.4 Analysis of Success Factors

The factor analysis result of success indicates that there is one factor with eigenvalue greater than 1.0. A one-factor solution is suggested after examining the results (see Table 8).

Component one is labeled “Success” and accounted for 65.314% of the variance. It contains all the items in success. The reliability is 0.9227.

## 7.5 Analysis of Challenge Factors

The factor analysis result of challenge indicates that there is one factor with eigenvalue greater than 1.0. A one-factor solution is suggested after examining the results (see Table 9).

Component one is labeled “Challenge” and accounted for 66.420% of the variance. It contains all the items in challenge. The reliability is 0.9274.

Table 7 Factor Analysis of Vendor Consideration

Component 1: Vendor Consideration		Factor Loading
V3	Service Quality	<b>.911</b>
V2	Technology Integration	<b>.892</b>
V4	Implementation Experience	<b>.875</b>
V1	Content	<b>.840</b>
V5	Implementation Cost	<b>.723</b>
V6	Reputation	<b>.344</b>
Eigenvalue		3.737
% of Variance		62.289%
Cronbach's Alpha		0.8658

Note. Boldface indicates highest factor loadings.

Table 8 Factor Analysis of Success Factors

Component 1: Success Factors		Factor Loading
S6	Provide Mentoring	<b>.863</b>
S5	Include Peer Interaction	<b>.837</b>
S1	Organizational Support	<b>.829</b>
S7	Offer Performance Feedback	<b>.820</b>
S3	Measure Everything	<b>.816</b>
S4	Include Independent Learners	<b>.810</b>
S2	Virtual Project Teams	<b>.793</b>
S8	Marketing	<b>.685</b>
Eigenvalue		5.225
% of Variance		65.314%
Cronbach's Alpha		0.9227

Note. Boldface indicates highest factor loadings.

Table 9 Factor Analysis of Challenge Factors

Component 1: Challenge Factors		Factor Loading
C3	Tutors and SMEs Integration	<b>.849</b>
C2	LMS Configuration	<b>.837</b>
C6	Back-End Systems Integration	<b>.821</b>
C4	Content Creation	<b>.816</b>
C7	Web Infrastructure	<b>.814</b>
C8	Online Access Capability	<b>.812</b>
	Training	
C1	Correct Target Setup	<b>.774</b>
C5	Multiple Modes of Learning	<b>.796</b>
Eigenvalue		5.314
% of Variance		66.420%
Cronbach's Alpha		0.9274

Note. Boldface indicates highest factor loadings.

## 8. T-Test of Seven Extracted Factors

T-test is conducted to examine whether there are significant differences between the above seven factors and whether the respondents have e-Learning systems in their organizations. The seven factors are “Cost and Unawareness” and “Immaturity” under barriers, “Training Effectiveness” and “New Revenues” under reasons for implementation, “Vendor Consideration”, “Success” and “Challenge”.

### 8.1 Barriers

The t-test result of “Cost and Unawareness” ( $t=-2.147$ ;  $p<0.05$ ) from t-test shows significant differences between the respondents who have no e-Learning systems in their organizations and those who have. However, the result of “Immaturity” ( $t=-.773$ ;  $p>0.05$ ) from t-test does not have significant difference. The mean value of “Cost and Unawareness” from the respondents who have no e-Learning systems in their organizations is 6.8158; while from those who have is 6.2879. It is obvious that the respondents who have no e-Learning systems in their organizations emphasize more on “Cost and



Unawareness” than those who have (see Table 10).

Table 10 Group Statistics of Cost and Unawareness

Group	Mean	t-value	p-value
① Without Organizational E-Learning Systems	6.8158	-2.147	0.034
② With Organizational E-Learning Systems	6.2879		

## 8.2 Reasons for Implementation

The t-test results of both “Training Effectiveness” ( $t=-.162$ ;  $p>0.05$ ) and “New Revenues” ( $t=.987$ ;  $p>0.05$ ) do not show significant differences between the respondents who have no e-Learning systems in their organizations and those who have.

## 8.3 Vendor Consideration

The t-test result of “Vendor Consideration” ( $t=-1.009$ ;  $p>0.05$ ) does not have significant differences between the respondents who have no e-Learning systems in their organizations and those who have.

## 8.4 Success

The t-test result of “Success” ( $t=-.683$ ;  $p>0.05$ ) does not have significant differences between the respondents who have no e-Learning systems in their organizations and those who have.

## 8.5 Challenges

The t-test result of “Challenge” ( $t=-.964$ ;  $p>0.05$ ) from t-test does not have significant differences between the respondents who have no e-Learning systems in their organizations and those who have.

At the end, we conclude that only “Cost and Unawareness” have significant differences between the respondents who have no e-Learning systems in their organizations and those who have. Furthermore, the respondents who have no e-Learning systems in their organizations obviously consider it more important than those who have. On the contrast, regardless the respondents who have e-Learning systems in their organizations or not, they do not significantly differ in the attitudes toward other remaining factors.

# 9. Conclusion

## 9.1 New Findings

The following represents the new findings of this investigation. They are gathered from the results of chi-square test, factor analysis and t-test.

### ① Results of Chi-Square Test

The results of chi-square test indicate that the majority of the respondents who have e-Learning systems in their organizations are mainly from industries. Most of the

respondents who have not e-Learning systems in their organizations also have not experiences of implementing e-Learning systems.

### ② Results of Factor Analysis

From the results of factor analysis, only the two factors in barriers have reliabilities lower than 0.4 which indicates low internal consistencies. However, the other five factors have reliabilities higher than 0.7 which represents high internal consistencies.

### ③ Results of T-Test

When examining the results of t-test, the respondents who have not e-Learning systems in their organizations emphasize more on “Cost and Unawareness” than those who have. However, whether the respondents have e-Learning systems in their organizations, they do not have significant different attitudes toward the other six factors which are “Immaturity”, “Training Effectiveness”, “New Revenues”, “Vendor Consideration”, “Success” and “Challenge”.

## 9.2 Contributions

The following represents the seven contributions of this investigation. They are approaches and considerations, advantages and disadvantages of e-Learning systems for e-Business, elementary concepts and understanding, useful information, examples of benefits, where corporations stand and references from other e-Learning stakeholders

### ① Basic Approaches and Considerations

There are some basic approaches and considerations proposed to help the corporations who are just getting started with the implementations of e-Learning systems for e-Business.

### ② Advantages and Disadvantages of E-Learning Systems for E-Business

It advises the decision makers what the advantages and disadvantages are. They shall balance from the situations they choose, and avoid the failures from other people’s experiences. Different stakeholders shall know their own responsibilities and jobs.

### ③ Elementary Concepts and Understanding

The elementary concepts and understanding about the implementations of e-Learning systems are introduced. It also gives a good e-Learning guide and roadmap. No matter the reader is a beginner or an expert, this paper can enrich his / her e-Learning knowledge.

### ④ Useful Information

All the analytical results in the study provide useful information on how the respondents rate on all the critical

factors proposed. The information leads corporations to have a successful e-Learning system for e-Business.

#### ⑤ Benefits

If corporations know respondents' attitudes toward the barriers, barriers are easier to be solved. By knowing the reasons for implementation, corporations can propose a sound e-Learning project. The results of vendor consideration can aid to choose an appropriate one. The rates of success and challenge factors undoubtedly give strong evidences for a better e-Learning system.

#### ⑥ Where Corporations Stand

With a clear understanding of these results, corporations know where they stand. Furthermore, they can setup corresponding strategies and objectives which lead them to a smooth implementation of e-Learning system for e-Business.

#### ⑦ References from other Stakeholders

The vendors of e-Learning solutions can figure out what end-users emphasize the most when choosing suitable vendors. Different stakeholders shall consider all the perspectives. By doing so, they can understand what others feel toward a better implementation of e-Learning systems for e-Business.

### 9.3 Limitations

There are five points of limitations must be acknowledged. All of them are listed and explained in the following. They are time, manpower, demographic, response rate, validity, flexibility and reliability limitations.

#### ① Time and Manpower Limitation

Due to the limited time and manpower, there are still spaces for further investigation.

#### ② Demographic Limitation

Most of the respondents came from Hsin Chu Science Park and National Chiao Tung University, so the results are limited to these areas.

#### ③ Response Rate and Validity

As people tend to dislike questionnaires, thus a low sample size is gathered. Furthermore, the conditions under which the questionnaires are finished cannot be controlled.

#### ④ Flexibility

Questionnaires are less flexible and therefore required more preliminary thought and preparation for their structures and contents.

#### ⑤ Reliabilities of "Cost and Unawareness" & Immaturity"

They are both under 0.4 which mean that their internal consistencies are low. Therefore, in the future study, new test items shall be developed.

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