A Fit-Gap Analysis of E-Business Curricula and Job Markets in Taiwan and the U.S.

Eldon Y. Li [1], Rebecca H.J. Yen [2]

1) National Chengchi University, College of Commerce, Department of Management Information Systems, Taiwan (eli@calpoly.edu)

2) National Central University, College of Management, Department of Information Management, Taiwan (hjyen@mgt.ncu.edu.tw)

Abstract

The world economy has revived since the dot-com bubble burst and the crisis of the millennium. Many enterprises are re-directing their resources into critical business areas to keep up with extrinsic changes. They adopt supply chain management (SCM) and enterprise resource planning (ERP) to ensure seamless integration with suppliers and customers, or enterprise application integration (EAI) to integrate stand-alone systems for quick responsiveness. This phenomenon indicates that electronic business (EB) application systems are playing an important role in the effectiveness of enterprise operations. However, the tide of EB curricula seems to be declining. Many researchers doubt whether current EB curricula really fit the needs of the job market. In our opinion, it is impossible to continue using traditional curricula in the digital economy. To gauge the rapid changes in EB education and profession, we collect EB curricula from top business schools and job announcements from career Web sites in both the U.S. and Taiwan. We compare the results between the two countries and derive practical suggestions for narrowing the gap between industry and academia.

***Keywords*:** Electronic business, curriculum supply, industry needs, job demand, fit-gap analysis.

1. Introduction

Information technology (IT) faces tremendous challenges, ranging from microprocessors to the Internet. IT not only changes business operations, but also influences business interrelationships. Since the digital economy meltdown at the start of the new millennium, most dot-com companies have failed to meet investors' expectations and many have rapidly vanished. This phenomenon, however, has not stopped the growing use of the Internet as an essential business tool (Pinker et al. 2002). Electronic business (EB) still plays a major role in many industries. According to a Forrester (2005) report, expenditure on IT goods has increased from 9% to 10%, especially on communications equipment, IT consulting, outsourcing services, and software. However, expenditure on computer equipment has slowed down. This means that IT investment is moving away from traditional IT facilities and toward modern Internet services. Therefore, to sustain their competitive advantages, it is vital that today's enterprises improve their EB strategies and processes. In general, EB can be described as a business model that encompasses almost any internet activity. Lal (2005) explained that EB encompasses information and communication technologies (ICTs) applications in all business processes, such as office automation, financial transactions, production processes, co-ordination with other plants, customer relationship management, supply chain management, and the management of distribution networks. E-business on the Internet, therefore, has the potential to revolutionize the way many businesses operate (Anderson et al. 2005). At the same time that enterprises invest in technology and initiate IT projects to support business growth, human resource managers are expanding their workforces, adding IT personnel gradually to meet individual staffing needs (Lee, 2005). However, it is often difficult for an enterprise to recruit professionals with the right skills. A constant complaint from recruiters is that there is still a lack of IT professionals in the new economy (ITAA, 2001). This problem may be attributed to a misalignment between academic curricula and the needs of industry. In a rapidly changing world, the human resource and IT requirements of modern business have resulted in an increased demand for EB specialists and a broader

application of EB technology. This, in turn, has increased demand for EB professionals who possess greater multidisciplinary knowledge. Today's academic programs must offer relatively novel EB curricula, in order to fully prepare students for effective assimilation into organizations (Becker et al. 1992). Weber (2004) has also claimed that the rapidly changing information technology and business environment represents a challenge for faculty members, who must constantly learn the latest technologies and are responsible for making education more closely related to industry demand. Because academics have an obligation to teach students effectively and to deliver a curriculum that is appropriate to the needs of their future employers (Stohr, 1995), identifying the gap between academics and industry is essential. The purpose of this study is to survey the EB job demand and academic curricula in Taiwan and the U.S. to explore the fit-gap differences in these two countries, one is a developing and the other is a developed country, respectively.

The organization of the remaining sections is as follows. First, a review of literature is presented. Second, the categories of academic curricula and professional job demand in EB are described. Third, the research method including data collection and classification is discussed. Fourth, the fit-gap analysis and its findings are described. Fifth, conclusions are presented and discussed. Finally, some managerial implications and directions for both academics and industry are provided.

2. Review of literature

Since the advent of Internet, there is an increasing demand for e-business specialists and wider application of EB technology due to intensified business competition. Universities have responded by embracing EB for their academic programs, particularly in schools of business and computer science (Etheridge et al. 2001). During the past few years, several researchers have surveyed EB academic programs and show increasing numbers of different EB degree programs (see Table 1).

Table 1. Trend of e-business degree programs

Author	Etheridge et al. (2001)	Krovi & Vijayaraman (2001)	Fusilier & Durlabhji (2003)
Data collection date	September, 2000	January, 2001	November, 2001
MBA degree	31	39	57
Master degree	23	15	35
Bachelor degree	5	7	30
Non-degree (certification)	18	17	N/A*

* N/A denotes the authors did not report this category

Others put their attention on discussing the requirement of credit hour, course categories, courses topic, programs orientation, and so forth (see Table 2). However, none of these studies has investigated whether the existing EB curricula in schools of business meet the job demand from industries. To fill this gap, Davis et al. (2003) surveyed top business schools and job market Web sites in the U.S. to understand the kinds of EB specialists American enterprises want and the types of courses the academics offer. They conducted a fit-gap analysis and recommended the following actions: 1) increase training in specialized software applications, 2) integrate EB into traditional business courses, 3) embrace wireless technologies, 4) emphasize training in EB security, 5) remain current in EB technologies.

Table 2. The relevant research of e-business program

Author	Data source	Sample size	Survey items
Durlabhji and Fusilier (2002)	AACSB*	67 US schools	Type of degree, course category, credit hour
Mechitov et al. (2002)	AACSB*, Peterson publications, BusinessWeek, US.News	36 US schools, 18 foreign schools	Type of degree, course content, programs orientation
Novitzki (2002)	AACSB*, CEC*, Top25**	143 US schools	Type of degree, courses topic

*American Assembly of Collegiate Schools of Business

** Certified E-commerce Consultants

*** Ranking from Computerworld magazine (Anonymous, 1999)

2.1 Categories of e-business curricula

ICTs play an important role in the development of modern education over the world (Albirini, 2006; Kennewell and Morgan, 2006). Recently due to the rapid expansion of EB, there is a tremendous demand for university EB curricula that meet the urgent needs of industry. Undoubtedly, numerous universities have begun to provide EB curricula as degree programs or as certificate programs to provide students with enough knowledge to fulfill the needs of industry. These EB curricula can be divided into four categories: business, e-business technical, e-business non-technical, and technology (Durlabhji and Fusilier, 2002).

(1) Business category

This includes business courses offered in traditional business programs, such as enterprise resource planning (ERP), supply chain management (SCM), customer relationship management (CRM), enterprise application integration (EAI), business process re-engineering (BPR), and financial management, etc. These courses should contain no systems-based, Internet-based, EB, or other technical-based focus.

(2) Technical category

This refers to traditional technical courses, such as Internet or Web programming and design, database management systems, data telecommunications, systems analysis and design, network practices and applications, and computer interface design.

(3) Technical EB category

This represents technical courses specifically related to EB, such as e-business systems development, electronic payment systems, e-business security, and radio frequency identification (RFID), etc.

(4) Non-technical EB category

This represents business courses specifically related to EB and focused on fundamental business issues, such as global e-business management, business models in e-business, business process re-engineering in e-business, legal and regulatory issues in e-business, and other EB-related issues.

2.2 Categories of e-business professionals

As EB continues its impact on firms today, educators and employers have realized the importance of providing and recruiting qualified EB professionals. Callahan and Pedigo (2002) have pointed out that IT professionals must also know how to address the diverse needs of stakeholders, stay abreast of the latest technologies, and leverage those technologies to maximize strategic advantages over competitors. As an EB professional, one must also know how to integrate IT tools with business processes. In our research, we classify EB jobs into two categories, technical and managerial, in accordance with Davis's et al. (2003) method.

The technical category consists of such subcategories as Web database, networking, programming, technical support, and Web administration. These subcategories usually include related technical skills, such as ORACLE, SQL, Internet protocol, Java, VB.NET, objective-oriented programming, ASP, XML, LAN/WAN, and distributed component object model/component object model (DCOM/COM). The managerial category can be further divided into such subcategories as analyst, manager, consultant, and other. These subcategories commonly include project management, risk management, industry analysis, SAS/SPSS, database management, ERP maintenance, CRM implementation, Web site engineering, business process control, SCM implementation, and market investigation. There are two reasons for using this classification scheme. First, although these hierarchical categories may not be exhaustive, they actually indicate the types of skills demanded within each career track (Davis et al. 2003). Second, Davis's job classification allows us to contrast job demand with EB curricula.

3. Research method

3.1 Sample

The paramount challenge facing both educator and employer is keeping up with an EB world that is constantly and rapidly changing. In the framework of this research, we investigate the trends of EB curricula in the U.S. and Taiwan and the gap between academic curricula and industry demand. The U.S. has the widest scope of experience and expertise in EB. Taiwan is the world's largest IT original equipment manufacturing (OEM) supplier. Both countries clearly play a vital role in the global EB market. Our source of EB curricula encompasses 38 top-ranked U.S. business

schools chosen from Davis's et al. (2003) research and 93 universities chosen from the online directory of Taiwan's Ministry of Education. By choosing these as our sample, we can confidently obtain representative results from these two countries. Hereafter, some factors that influence EB curricula and trends in the two countries are revealed. Similarities and differences are identified, and strengths and weaknesses are carefully examined and discussed.

3.2 Data collection and classification

To facilitate comparison, we adopt the systematic comparative analysis method suggested by Bereday (1964). This method has two phases: (1) local research focused on one country alone and (2) comparative research focused on multiple countries simultaneously. The local research represents the preliminary phase of a comparative study. The steps employed in the local research are investigation, content analysis, data coding, classification, validation, and fit-gap analysis.

3.2.1 Investigation of e-business curricula

As mentioned earlier, the 38 top-ranked business schools in the U.S. and the 93 universities in Taiwan (limited to management and business colleges) were selected as our research sample, because these schools and universities are representative of higher education in each country. They provided a basis for us to investigate several factors that affect EB curricula and the situation in the two countries. To ensure that the data from our sample schools were accurate and that the sample included both schools with an EB concentration program and those with a sub-track EB program, we conducted an exhaustive Web site search during April, May, and June to collect a list of the EB programs on offer. After scrutinizing the EB programs that appeared on the Web sites, some interesting factors were revealed. We chose those programs that were described in detail on the Web sites and obtained a total of 21 EB programs in both countries. These programs could be further divided into the six categories proposed by Davis et al. (2003): Master in e-business, MBA with a concentration in e-business, Master with a concentration in e-business, Bachelor's in e-business, Bachelor's with a concentration in e-business, and Certificate in e-business (see Table 3).

Table 3. The six categories of e-business programs in Taiwan and the U.S.

Categories of e-business programs	U.S.	Taiwan
Master in E-business	3	3
MBA with a concentration in E-business	11	1
Master with a concentration in E-business	1	1
Bachelor of E-business	0	3
Bachelor with a concentration in E-business	1	13
Certificate in E-business	5	0
Total	21	21

The most common programs are the MBA with a concentration in e-business (11 programs in the U.S.) and the Bachelor's with a concentration in e-business (13 programs in Taiwan). We also observed that five schools in the U.S. offer certificate programs in EB, although there are no similar certificate programs in our Taiwanese sample. These data may indicate that there is a lack of certificate EB programs, and a neglect of EB MBA programs, in Taiwan. Furthermore, the quantity of student supply in the U.S. is relatively lower than in Taiwan, because MBA class size tends to be smaller than that of undergraduate class.

3.2.2 Investigation of e-business job demand

Because corporations prefer to hire candidates who already possess the skills and knowledge to succeed (Callahan and Pedigo, 2002), we conducted a content analysis of several job market Web sites in Taiwan and the U.S. to investigate industry demand for EB professionals in the two countries. This part of research encompassed three U.S. career Web

sites (Moster.com, CareerBuilder.com, and Yahoo Hotjobs) and two Taiwanese career Web sites (104 JobBank and 1111 JobBank). Moster.com, CareerBuilder.com, and Yahoo Hotjobs were ranked as the top U.S. job Web sites by 100.com in 2004 (Anonymous, 2004), whereas 104 JobBank and 1111 JobBank are the best-known career Web sites in Taiwan. Data were collected from these Web sites without any restrictions (e.g., by location, industry, seniority, or salary) to ensure representative results for demand. We collected data from the Web sites over three months (April, May, and June) and came up with a total of 1,006 U.S. and 268 Taiwanese job announcements (see Table 4).

Table 4. Position demand from Taiwan and U.S. career Web sites

	U.S. career Web sites			Taiwan career Web sites		
Month	**Monster.com**	**CareerBuilder.com**	**Yahoo Hotjobs**	**104 JobBank**	**1111 JobBank**	**Row total**
April	70	76	53	49	23	271
May	111	50	59	75	24	319
June	153	100	334	65	32	684
Total	334	226	446	189	79	1274

According to Table 4, the average number of job listings on Web sites in the U.S. was higher than that in Taiwan and June accounted for the highest level of demand. Therefore, the industry demand was certainly higher in the U.S. than in Taiwan and June is the better period to look for jobs. The data collected from these Web sites allows us to analyze the fit-gap of curricula and job demand described in the later section.

3.2.3 Data coding and classification of e-business curricula

We examined curricula in Taiwan and the U.S. according to type, number of business programs, number of technology programs, and number of EB programs. E-business programs are further divided into technical or non-technical curricula. This dichotomy was proposed by Durlabhji and Fusilier (2003) as shown in Table 5. The purpose of this coding mechanism is to offer a general scenario for the types of programs provided in the EB discipline. Furthermore, we reviewed program syllabi and descriptions to evaluate whether all of the program titles are suitable for placement in certain categories. We discuss these categories in detail in the following.

(1) Business programs

This category consists of traditional business management programs, such as operations and supply chain management, enterprise resource and financial planning, with a macro view of business operations and without a computer orientation.

(2) Technology programs

Programs with a technical basis are categorized as technology programs. This category includes traditional computer science programs, data communication programs, and computer language programs, but should not include programs with an EB focus.

(3) E-business non-technical programs

This category has a non-technical orientation. Programs that are related to EB but do not have a technical focus, such as EB marketing, EB strategy, introduction to EB, and EB management belong in this category.

(4) E-business technical programs

E-business programs that specifically focus on the Internet or on its architecture are in this category. They include EB security, EB practicum, EB technology, electronic payment systems, and other EB programs that are highly technical in nature.

Table 5. E-business course categories in Taiwan and the U.S.

Course Category	U.S.	Taiwan	Difference	
Business	**11.80%**	**16.48%**	**4.68%**	
Operations and Supply Chain Management	4.90%	7.41%	2.51%	
Enterprise Resource Planning	1.20%	2.96%	1.76%	
Financial	5.70%	6.11%	0.41%	
E-Business Non-Technical	**60.70%**	**39.44%**	**-21.26%**	*****
E-Business Marketing	14.20%	7.22%	-6.98%	*
E-Business Strategy	14.60%	6.67%	-7.93%	*
Introduction to E-Business	2.80%	4.44%	1.64%	
E-Business Management	9.30%	10.00%	0.70%	
Entrepreneurship in E-Business	4.90%	1.30%	-3.60%	
E-Business Economics and Markets	8.50%	3.15%	-5.35%	*
Global E-Business Management	0.00%	0.93%	0.93%	
Business Process Reengineering in E-Business	1.60%	2.04%	0.44%	
Legal and Regulatory Issues in E-Business	1.20%	2.59%	1.39%	
Business Models in E-Business	1.60%	1.11%	-0.49%	
Business to Business	2.00%	0.00%	-2.00%	
E-Business Technical	**19.30%**	**22.41%**	**3.11%**	
E-Business Technology	9.80%	13.70%	3.90%	
E-Business Systems Development	5.30%	3.70%	-1.60%	
E-Business Practicum	2.80%	1.30%	-1.50%	
E-Business Security	1.40%	3.70%	2.30%	
Electronic Payment Systems	0.00%	0.00%	0.00%	
Technology	**7.90%**	**17.04%**	**9.14%**	*****
Data Communications	3.50%	4.44%	0.94%	
Data Management	1.60%	7.59%	5.99%	*
Interface Design	1.20%	0.37%	-0.83%	
Java and Object-Oriented Programming	0.80%	2.59%	1.79%	
Intelligent systems	0.80%	1.48%	0.68%	
Computer Ethics	0.00%	0.56%	0.56%	
Other	**0.00%**	**4.63%**	**4.63%**	

* denotes the different is 5% or over.

3.2.4 Data coding and classification of e-business jobs

In essence, EB is about business innovation and about serving new and changing markets. Today's graduates face a career world in which professionals are expected to be competent in a wide range of technologies. This implies that there is industry demand for EB professionals as they receive multidisciplinary training and possess cross-functional knowledge. Here, we have analyzed Web site advertisements to determine job opportunities in the general category of EB professional. The content analysis of the data revealed several interesting job titles, such as Web database design, project management, and EB consultant. These jobs can be further classified into two major categories – technical skills and managerial skills – as mentioned earlier and proposed by Davis et al. (2003) (see Table 6).

Table 6. E-business job categories in Taiwan and the U.S.

Job Category	U.S.	Taiwan	Difference	
Technical	**31.23%**	**47.01%**	**15.78%**	*
Web Database – Design	0.50%	0.00%	-0.50%	
Web Database – Architecture	0.80%	0.00%	-0.80%	
Web Database – Administration	1.99%	0.37%	-1.62%	
Web Administration	3.68%	4.85%	1.17%	
Programming - Advanced High-End Programmer (ERP/CRM/SCM/EAI)	7.85%	4.48%	-3.37%	
Programming - Advanced Web Programmer	5.67%	31.34%	25.67%	*
Technical Support	5.17%	2.99%	-2.18%	
Networking	5.57%	2.61%	-2.96%	
Programming - Advanced Mobile Web Engineer	0.00%	0.37%	0.37%	
Programming - Legacy Systems	0.00%	0.00%	0.00%	
Managerial	**68.78%**	**52.98%**	**-15.80%**	*
Analyst - Project	3.58%	3.36%	-0.22%	
Analyst - Business	3.58%	1.87%	-1.71%	
Manager - Business Development	4.57%	10.82%	6.25%	*
Manager - Marketing	11.93%	22.01%	10.08%	*
Manager - Project Management	5.86%	9.33%	3.47%	
Consultant - ERP/CRM/SCM/EAI	19.38%	1.12%	-18.26%	*
Consultant - E-Business Architecture	6.66%	2.61%	-4.05%	
Consultant - Technology Audit, Risk Assessment	1.69%	0.37%	-1.32%	
Consultant - Knowledge Management	0.10%	0.00%	-0.10%	
Consultant - Vertical Industry Specialist	10.44%	0.37%	-10.07%	*
Other	**0.99%**	**1.12%**	**0.13%**	

* denotes the different is 5% or over.

3.3 Reliability and validity of data

Whenever source data require coding into categories, there are concerns of content validity and inter-coder reliability. Content validity ensures that the measures include an adequate and representative set of items accurately reflecting the domain of the construct as defined conceptually. Cavana et al. (2001) suggests achieving content validity through literature review and experts' judgment. We therefore conducted a literature review for EB curriculum and job categories, and consulted with three industry managers and four MIS academicians. After reviewing and discussing with these experts, job category proposed by Davis et al. (2003) and curriculum category proposed by Durlabhji and Fusilier, (2002) were chosen as the classification scheme of this study. The process of literature reviews and expert consultation ensures the content validity of our data. As for coding the data into categories, significant risk of bias exist when only one coder is in charge. However, two or more coder will incur the need of ensuring consistent coding between coders, known as inter-coder reliability (Kassarjian, 1977). In our study, two coders were assigned to identify and classify all curricula and job positions on the Web sites. When a course or job position was found, the two coders independently classified it into pre-established categories. At the end of the data collection process, any difference in classification was discussed and resolved. The significant differences in classifying job positions between the two coders were Manager–Business Development and Manager–Project Management (disparity in 15.25%; i.e., 84.7% inter-coder reliability). Moreover, the significant difference in classifying courses between the two coders was E-business Management (disparity in 21.54%; i.e., 78.5% inter-coder reliability). This could be due to the wide coverage of management tasks being usually overlapping each other and making the coders unable to demarcate its boundary. Eventually, all the differences were resolved and the classifications were consistent between the two coders.

3.4 Fit-gap analysis

In order to identify significant differences between curricula and job demand, we conducted fit-gap analyses (Davis et al. 2003). By a fit or gap, we mean the small or large extent to which the percentages of the job demands and the EB curricula differ. In this section, we treat the percentage of demand in a job category as the demand, and the percentage of course offer in a curriculum category as the supply. Based on supply and demand, we present the fit-gap analyses for U.S. and Taiwan independently, followed by a comparative analysis between the two countries. During the analysis of fits and gaps, we classify a difference into balance, shortage, and over-supply categories. When the absolute value is less than 5% and its ratio to the percentage of job demand is less than one, the difference is considered as having a balance. Otherwise, it is in either over-supply or shortage category. When the percentage of job demand is less than 10%, a balance is considered as a low balance; otherwise, it is a high balance. Therefore, there are four quadrants of fit-gap differences: over-supply, shortage, low-balance, and high-balance. The characteristics of these quadrants follow.

(1) Over-supply (low demand and high supply)

The situation in this quadrant is one in which the education system puts too much emphasis on courses for which there is little industry demand. For example, if too many EB marketing and EB technology courses are offered, supply may exceed demand, leading to a higher unemployment rate and, thus, a heavy burden on the national unemployment insurance system.

(2) Shortage (high demand and low supply)

This quadrant reflects a situation in which industries are willing to recruit talent extensively to help their business operations and thus their competitiveness, but the supply of relevant courses is limited.

(3) Low-balance (low demand and low supply)

In this quadrant, both industry demand and the supply of relevant courses are very limited. Firms recognize the benefits of EB and implement EB technologies, but they tend to do so on a more limited scale and thus have a lower demand for specialists. Although supply and demand are judged as low-balance in this quadrant, such a balance could be the stepping-stone for stimulating the EB market from infancy to maturity.

(4) High-balance (high demand and high supply)

This quadrant is the ideal condition and represents a situation in which schools have fully aligned their curricula with the corresponding industry demand. Schools in this quadrant not only come closest to narrowing the gap between theory and reality, but also introduce their students to the latest technologies, as they act as a supplier to the demands of industry. This means that students have sufficient marketing knowledge to succeed in the EB job market, and the industries can find the qualified talent to meet their needs.

4. Results

4.1 E-business curricula in the U.S.

Figure 1 displays the percentages of curriculum categories (i.e., business, e-business non-technical, e-business technical, and technology) for Master, Bachelor, and non-degree programs. The results show that most EB curricula in the U.S. are offered in EB non-technical programs rather than in other categories. This implies that students in business schools are not trained to create or maintain EB systems, but they do need to understand the broad concepts of EB technologies so that they can develop business models or strategies. Moreover, Master programs offered a higher percentage of e-business non-technical curricula than do Bachelor programs. In contrast, Bachelor programs have greater e-business technical content. This reflects the different orientations of the two degree programs. That is, the curricula provided to Master degree students focused more on EB non-technical programs than on technical ones. In non-degree program curricula, we found that 61.54% was EB non-technical and 18.46% EB technical. This indicates that there is a strong interaction between industry and academia, because non-degree (certificate) programs are intended for full-time practitioners undergoing part-time extended education.

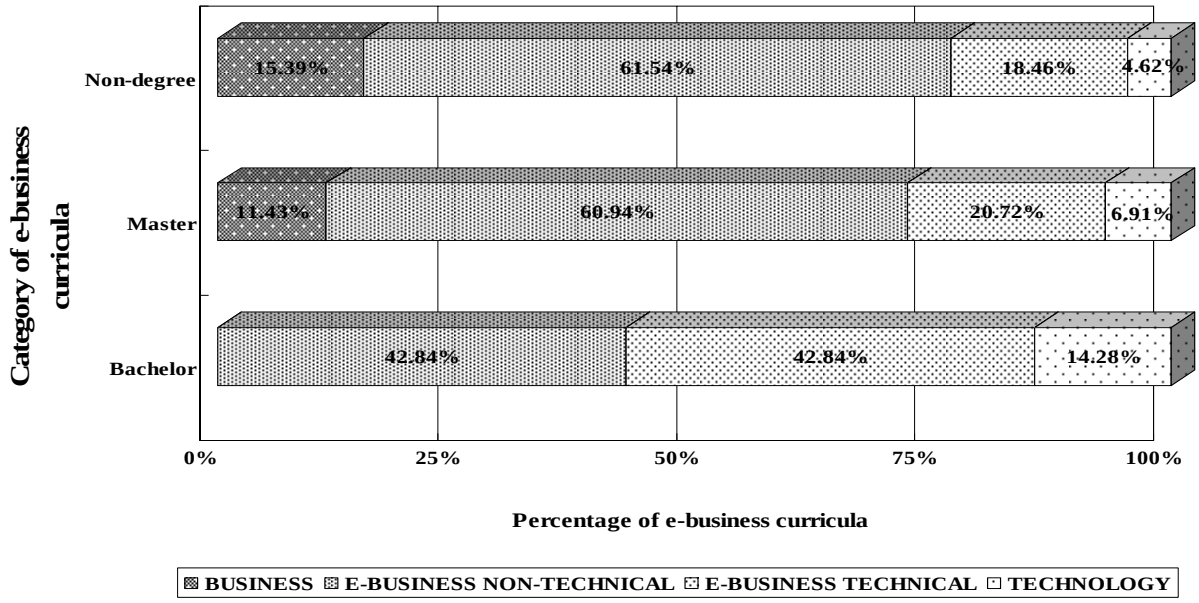

Figure 1. E-business curricula in the U.S.

4.2 Demand for e-business professionals in the U.S.

Advanced programming positions (high-end programmers and Web programmers) account for 13.52% of the demand in the technical job category (see Table 6). These types of positions are different from traditional programming in that they focus on business engineering (e.g., ERP, SCM implementation). Networking (5.57%) and technical support (5.17%) positions ranked as the second and third most in demand. This indicates that networking and technical support are areas that receive a lot of attention in the e-business field, and they are considered part of the infrastructure that supports business operations. With e-commerce and e-business growing rapidly, we find a high demand in the managerial job categories of consultant–ERP/CRM/EAI (19.38%) and consultant–vertical industry specialist (10.44%) (see Table 6). The advertisements listed on the Web sites sought expertise in specific ERP software programs (e.g., Oracle E-Business Suite 11i). The position of manager–marketing (11.93%) was the second most in demand. This reflects the intentions of industries to hire qualified specialists who are responsible for coordinating enterprise-wide developments and for the implementation of comprehensive marketing plans and marketing budgets.

4.3 Significant fits and gaps in the U.S.

4.3.1 Managerial professions

The job positions we investigated reveal that there is a high demand in industry for consultants with suitable knowledge of ERP, CRM, EAI, and SCM. These jobs accounted for 19.38% of all positions. However, the investigation of EB curricula provided by the sample schools reveals that the related EB courses such as ERP (1.2%), BPR (1.6%), and SCM (4.9%) are not emphasized in the academics. Even though CRM is important to making long-term relationships with customers, and EAI is necessary for interorganizational operations, we found no courses offered in these two sub-categories. This indicates a gap in this area (Shortage 1). The situation is different with the job that is second most in demand – manager–marketing (11.93%). We found a relatively high supply of courses on EB marketing (14.20%), which indicates that the sample schools have responded to this specific industry need, and there is thus a balance between curriculum supply and industry demand, both having high percentages (High-balance 1). However, with respect to the position of consultant–vertical industry specialist (which is third most in demand, at 10.44%), we found no courses that focus specifically on this area. This means that there is a gap in the supply of trained consultants with vertical integration skills and industry knowledge (Shortage 2). This result is to our expectation because qualified consultant of vertical integration must be trained through real-life on-the-job assignments, not through academic courses.

4.3.2 Technical professions

In the technical professions, the position most in demand is programming–advanced high-end programmer (7.85%), the corresponding curriculum categories are SCM (4.90%) and ERP (1.20%), with a total of 6.3% (Low-balance 1). There are no courses offered in CRM and EIA. Conversely, with networking (5.57%), the job second most in demand in this category, there appears to be a relatively good fit with courses in data communication (3.50%). Thus, we conclude that the courses provided by our sample schools have responded to this specific industry need, and there is a balance (with low percentages) between curriculum supply and industry demand (Low-balance 2). Note that data communication courses usually focus on the fundamentals of data communication networks and aim to give some insight into why networks are currently structured as the way they are and to provide an understanding of the issues facing data network designers. Demand for EB technical support (5.17%) appears to be sufficiently met (Low-balance 3) by the number of courses offered in EB technology (at 9.80%, the largest percentage of EB courses). The results also reveal that there is a relatively high demand for Web programmers (5.67%), but we found very few courses offering Java and objective-oriented programming (0.80%), revealing a gap in this area (Shortage 3). There is also a relatively high demand for Web administration professionals (3.68%), and an essential issue for Web administrators is EB security. There are 1.40% of the courses offering EB security, indicating a fit between Web administration and EB security (Low-balance 4). These results shed light on the dynamics between industry and academic attention to EB. The industries and schools discussed herein face the same job market, but view the EB context in different ways. Based on our fit-gap analysis, the following conclusions can be drawn. First, there is no case of over-supply. Second, industry demand and the curricula has a poor fit relevant to the positions of consultant–ERP/CRM/SCM/EAI, consultant–vertical industry specialist, and Web programmer. No enough curricula are offering courses for these professions. Therefore, curricula in these areas should be expanded to lower the costs of employee education and training for industry. Third, we found four cases (i.e., programming–advanced high-end programmer, networking, technical support, and Web administration) that fell into low-balance. This may indicate that although the U.S. is a well-developed country, many of its EB job positions are now going offshore to cut costs (e.g., many business processes are outsourced to Infosys Technologies in India). Finally, there is a high demand for Manager–marketing profession in the U.S. and the sample schools have been offering EB marketing courses to meet this need (see table 7).

Table 7. E-business course supply and job demand matrix (U.S.)

	Job demand low	Job demand high
Course supply high	*Over-supply* No samples occurred in this area	*High-balance 1:* Manager–Marketing (11.93%) vs. E-business marketing (14.20%)
Course supply high	*Low-balance 1:* Programming–Advanced high-end programmer (7.85%) vs. SCM (4.90%) and ERP (1.20%) *Low-balance 2:* Networking (5.57%) vs. Data communication (3.50%) *Low-balance 3:* Technical support (5.17%) vs. E-business technology (9.80%) *Low-balance 4:* Web administration (3.68%) vs. E-business security (1.40%)	*Shortage 1:* Consultant–ERP/CRM/SCM/EAI (19.38%) vs. SCM (4.90%), BPR (1.60%), and ERP (1.20%) *Shortage 2:* Consultant–Vertical industry specialist (10.38%) vs. Vertical courses (0.00%) *Shortage 3:* Web programmer (5.67%) vs. Java and objective-oriented programming (0.80%)

4.4 Supply of e-business curricula in Taiwan

The results of the survey indicate that most EB curricula offered in Taiwan fall into the EB non-technical category (see Figure 2). This indicates that the intent of the EB curricula in Taiwan is to prepare business management students for the EB job market. Similar to that of the U.S., the percentage of EB non-technical curricula is higher in Master programs (54.54%) than in Bachelor programs (43.33%). Conversely, the percentage of EB technical curricula is higher

in Bachelor programs (25.01%) than in Master programs (19.70%). Unlike the U.S. curricula that focus on technical training, the undergraduate students in Taiwan receive more non-technical business training. Overall speaking, the proportions of technical and non-technical training for both Master programs and Bachelor programs are very much the same, indicating the emphasis of business training of EB programs in Taiwan. We also found that there is no technology curriculum offered in any non-degree programs.

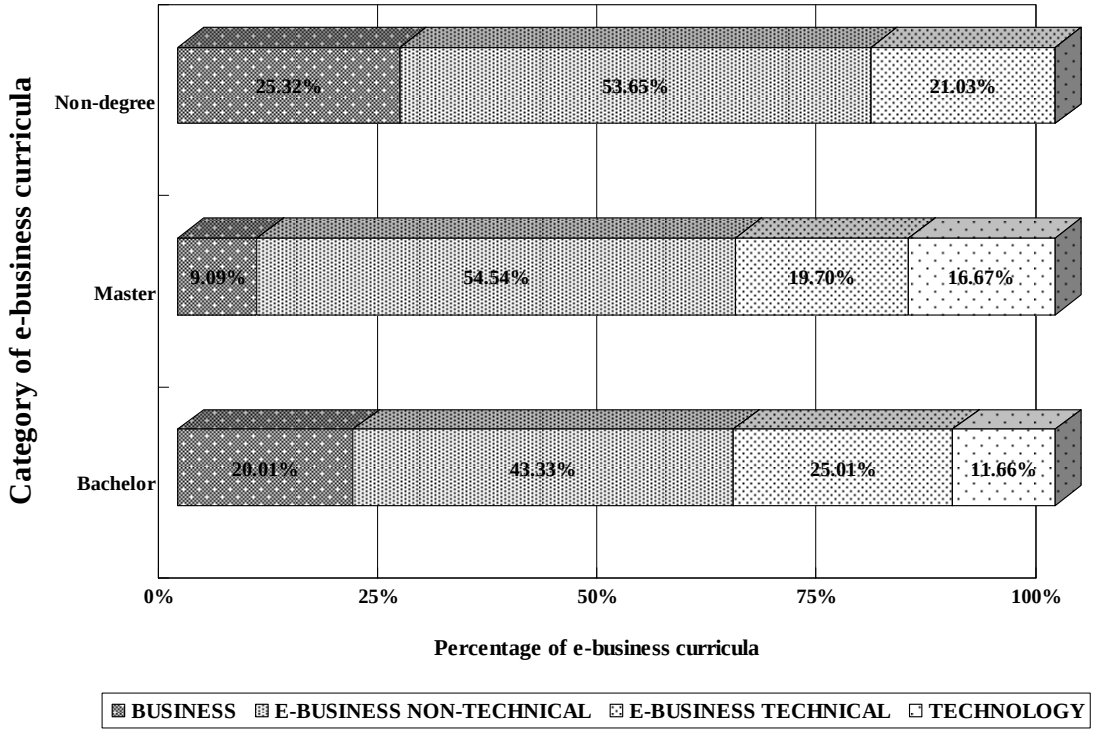

Figure 2. E-business curricula in Taiwan

4.5 Demand for EB professionals in Taiwan

In the technical job category (see Table 6), Web programmer (31.34%) is the position most in demand. This indicates that enterprises in Taiwan have a great demand for Web programmers to write codes for their business operations (e.g., ASP or PHP programmers). We found no demand in the area of Web database design and architecture. This may indicate that the Web sites of most Taiwanese companies have few transactional applications; their Web sites are used only to display company profiles or exhibit products. Moreover, most Taiwanese enterprises are small median enterprises (SME) with limited budgets. They usually take advantage of a Web programmer rather than a database administrator to maintain their database systems. In the managerial job category, the two positions most in demand are manager–marketing (22.01%) and manager–business development (10.82%). This shows that the center of gravity for businesses in Taiwan has migrated from the technical aspect to the managerial aspect. Hiring a qualified employee in a specific field to explore new markets will bring new opportunities and accelerate the success of EB. However, Taiwanese enterprises seem to have little demand for ERP/CRM/EAI consultants (1.12%). This suggests that enterprises in Taiwan incline to rely on consultancy groups from overseas (e.g., SAP consultants) and seldom cultivate consultancy talent themselves.

4.6 Significant fits and gaps in Taiwan

4.6.1 Managerial professions

The job positions we investigated reveal a high demand in industry for managers with knowledge of marketing – these accounted for 22.01% of all job positions. However, the EB curricula provided by the sample schools reveal that only 7.22% of EB courses aim at EB marketing. This indicates a significant gap in the EB marketing area (Shortage 1), which is considered a critical function for companies to attract prospective customers. Data from our sample job Web sites indicate a relatively high demand for business development (10.82%) and project management (9.33%). In the EB

curricula we surveyed, there is also a relatively high emphasis on the two related courses: EB management (10.00%) and EB technology (13.70%). Hence, we conclude that the curricula in the sample schools have responded to these specific demands, resulting in a well fit (High-balance 1). Consultants with knowledge of ERP, CRM, SCM, and EAI are low in demand and accounted for only 1.12% of all job positions. With respect to courses for this job position, there seems to be an over-emphasis on SCM (7.41%), BPR (2.04%), and ERP (2.96%) courses (Over-supply 1).

4.6.2 Technical professions

There is a relatively high demand for Web programming professionals (31.34%). However, we found very few courses offered in Java and objective-oriented programming (2.59%). This indicates a significant gap, with few EB courses providing enough of the specialized software tools, such as Oracle, SQL, ASP, DCOM, and Java, which are essential to Web programmers (Shortage 2). Web administration positions were scored at 4.85%, whereas only 3.70% of courses offered are in EB security, and none are in EB payment systems (Low-balance 2). Programming–advanced high-end programmer (4.48%) is the job second most in demand in the technical profession category and it appears to be met by the number of courses (10.37%) provided in SCM (7.41%) and ERP (2.96%). This reveals an over emphasis in this area (Over-supply 2). Demand for EB technical support (2.99%) also appears to be the same situation (Over-supply 3). It is supported by the large number of courses offered in EB technology (13.70%, the largest percentage of EB curricula). The demand for networking professionals is relatively low (2.61%). Correspondingly, it appears there is a relative fit with data communication courses (4.44%). Hence, we conclude that the courses offered by our sample schools have responded to this specific industry need and show a well balance (Low-balance 2). Finally, the results also show that there is very low demand for mobile Web engineers (0.37%) and also no courses on mobile engineering is offered. Contrary to the U.S., which had no case of over-supply, Taiwan has all four combinations of supply and demand: two shortages, three over-supplies, two low-balances, and one high-balance (see Table 8). Based on the fit-gap analysis, we can make the following conclusions. First, Taiwan's EB curricula are in line with demand from job market for business development, project management, Web administration, and networking. Second, the educational system in Taiwan pays too much attention to courses that do not cater to industry demand. As a result, there are too many courses offered in SCM, ERP, and EB technology; the supply exceeds the demand and will cause an imbalance in the job market. Therefore, schools in this quadrant should balance the courses that are over-supplied. For example, they should balance SCM/ERP courses and EB technology courses in the required general curriculum. Finally, the current shortages in Taiwan's EB curricula are EB marketing and Java and objective-oriented programming. Our finding suggests that curricula in educational programs must extend to EB marketing and Web programming knowledge to help industry train suitable professionals.

Table 8. E-business course supply and job demand matrix (Taiwan)

	Job demand low	**Job demand high**
Course supply high	***Over-supply*** No samples occurred in this area	***High-balance 1:*** Manager–Marketing (11.93%) vs. E-business marketing (14.20%)
Course supply low	***Low-balance 1:*** Programming–Advanced high-end programmer (7.85%) vs. SCM (4.90%) and ERP (1.20%) ***Low-balance 2:*** Networking (5.57%) vs. Data communication (3.50%) ***Low-balance 3:*** Technical support (5.17%) vs. E-business technology (9.80%) ***Low-balance 4:*** Web administration (3.68%) vs. E-business security (1.40%)	***Shortage 1:*** Consultant–ERP/CRM/SCM/EAI (19.38%) vs. SCM (4.90%), BPR (1.60%), and ERP (1.20%) ***Shortage 2:*** Consultant–Vertical industry specialist (10.38%) vs. Vertical courses (0.00%) ***Shortage 3:*** Web programmer (5.67%) vs. Java and objective-oriented programming (0.80%)

4.7 A comparison of e-business curricula and industry needs in Taiwan and the U.S.

The curricula of higher education in Taiwan have been greatly influenced by the U.S. educational system. The EB curricula are no exception. In various cases, the advanced experience of EB professionals in the U.S. has served as a model for professionals in Taiwan. In order to identify the differences in fits and gaps between Taiwan and the U.S., we scrutinize Tables 5 and 6. As shown in Table 5, schools in the U.S. tend to offer much more EB non-technical courses than their Taiwan counterparts, specifically in EB marketing, EB strategy, and EB economics and markets. Taiwan's schools, in contrast, offer much more data management courses than the U.S. schools do. Regarding job demands, Table 6 reveals that the industries in the U.S. recruit more managerial professionals than those in Taiwan, especially the managers in business development and marketing, and the consultants in ERP/CRM/SCM/EAI and vertical integration.

The demand for consultants–ERP/CRM/SCM/EAI in the U.S. is scored at 19.38%, whereas it is only 1.12% in Taiwan. This may indicate that ERP and SCM have become vital for almost every American business to improve its competitiveness, thus ERP/SCM consultant has become a job in high demand in the U.S. In contrast, most businesses in Taiwan are small or medium and do not have a sufficient budget to afford enormous expenditures on ERP or SCM systems. This affects the demand for ERP/SCM consultants. Both Taiwan and the U.S. play important roles in the global supply chain networks. To help the industries compete successfully worldwide, the U.S. schools should put more effort into enhancing training in SCM, ERP, CRM, EAI, and vertical business skills; while Taiwan should reduce the number of these courses. The demand for manager–marketing professionals in Taiwan was scored at 22.01%, whereas EB marketing courses only made up 7.22% of courses offered. The demand for manager–marketing professionals in the U.S. was scored at 11.93%, whereas 14.20% of EB courses offered were in marketing. This indicates that educators in the U.S. emphasize EB marketing due to the high demand for marketing managers. Taiwan does not pay much attention to the course subject. Finally, the demand for advanced high-end programmer in the EB context of Taiwan and the U.S. are different. The demand for advanced high-end programmers (7.85%) fits the curricula supply (6.1%) in the U.S., whereas it is much smaller than the percentage of related courses (10.37%) in Taiwan. That is, Taiwan has an over-supply situation, while the U.S. is low-balance. This implies that Taiwan's industries could be the potential outsourcing partners for their counterparts in the U.S. in advanced high-end programming project.

5. Conclusions and recommendations

This study collects EB job announcements and curricula from various Web sites in the U.S. and Taiwan. The data are manually coded through content analysis to come up with descriptive statistics. These statistics are further analyzed by fit-gap analysis to explore the differences between industry needs and academic curricula in EB profession. In addition, we compare the current situations in Taiwan and the U.S. to understand the differences between the two countries. There are several conclusions and recommendations that emerge from this investigation.

5.1 Enhancing ICT training

EB consultants need a fundamental knowledge of what is involved in ICT, because an EB system normally encompasses applications of ICT in all business processes. They must grasp such enterprise communication concepts as SCM, ERP, and EAI. Therefore, U.S. business schools should make a number of enhancements in their curricula to respond to industry needs. In doing so, universities would benefit from creating courses that are more relevant to industry and student needs, and industry would benefit from being able to hire graduates who are more fully prepared to meet their needs (Davis et al. 2003). In Taiwan, ICTs are still in their infancy. An upgrade of ERP, SCM, and EAI infrastructure and more education about enterprise integration know-how for business professionals are the key challenges Taiwan must face if it expects to flourish in the coming decades. Taiwanese industry will face challenges to its survival and competition in the e-era, as it must compete with international conglomerates that are heavily loaded with cash and sophisticated technologies. This means that if the poor fit between industry and education is not improved, it may prevent industrial maturity in the region. In addition, small and medium enterprises should be more educated in ICT applications, as Taiwan still lags behind the trends in the U.S.

5.2 Increasing needs for e-marketing training

Conventionally, the role of marketing manager has been to establish, maintain, and enhance relationships with customers and other partners at a profit, so that the objectives of the parties involved are met (Grönroos, 1990). As time goes by, the role of marketing manager has changed, and he or she now needs more EB marketing knowledge than ever. Marketing managers need to understand the use of recent advances in ICTs to facilitate the development and maintenance of relationships. ICT is now a well-established component in the marketing strategies of many

organizations (Hoffman and Novak, 1996). However, despite its popularity, EB marketing has not yet evolved into a common practice in Taiwan. This may be because EB marketing is a new and rather poorly defined subject (Granitz and Hugstad, 2004). Therefore, to meet the industry demand, business schools in Taiwan have to place more emphasis on introducing e-marketing with respect to the knowledge and skills that are required by marketing managers. In the U.S., in contrast, EB marketing is a commonly accepted course that addresses concepts and skills that are critical to a broad range of careers and industries. EB marketing programs are designed to teach new marketing concepts and skills and the underlying business foundations required for the understanding and development of marketing management in the e-era.

5.3 Increasing needs for e-business programmer training

E-business programmers should be familiar with ICT-related programs, such as SAP, Oracle, and Java. Our research shows that SCM and ERP courses for high-end EB programmers seem to be insufficient in both nations. These programs are the foundation of a seamless integration across organizations, and high-end programmers usually play an important role in EB operations. Therefore, a solution to this gap is to create a partnership between academia and industry. For example, through cooperation with industry, schools could create non-degree (certificate) programs for their students and grant them certificates after verifying their proficiencies (e.g., MSCE, Oracle JDBC Programmer, or Sun Certified Solaris Administrator). In doing so, schools would benefit by offering certificate courses that are more relevant to industry needs, and software companies (e.g., Microsoft, Oracle, Sun, etc.) would benefit from introducing their products to campuses and further increasing their market share.

5.4 Increasing needs for networking specialist training

A recent survey conducted by the U.S. Bureau of Labor Statistics (2005) on employment growth in different occupations from 2002 to 2012 suggests that the networking field may offer increasing employment opportunities in the future, and data communications analyst is predicted to be the second fastest growing occupation in the U.S. during the period. This indicates that the U.S. still has a high demand for networking specialists. However, our findings show that data communication curricula are still insufficient to satisfy industry needs. In contrast, Taiwanese schools place too much emphasis on data communication courses. According to the Marketing Intelligence Center (2005) survey, expenditure on networking communication in Taiwan was only rated at 13%. This may indicate that there is less need for networking communication in Taiwan. Therefore, to conserve educational resources, schools should not overly offer data communication courses.

References

[1] Albirini, A. Teacher's attitudes toward information and communication technologies: the case of Syrian EFL teachers, Computers & Education, Vol. 47, No. 4, pp 373-398, 2006.

[2] Anonymous (2004), 100 top career sites. <http://www.100topcareersites.com>

[3] Anonymous (1999). "Top 25 Techno MBAs," Computerworld, 22, 39, 27-31, September 27, 1999.

[4] Anderson, B. B. Hansen, J. V. Lowry, P. B. Summers, S. L. Model checking for design and assurance of e-business process, Decision Support System, Vol. 39, pp 333-344, 2005.

[5] Becker, S. A. McGuire, G. G. Medsker, L. R. Integrating System Development Theory and Practice in an Information Systems Curriculum, Computers & Education, Vol. 19, No. 3, pp 275-284, 1992.

[6] Bereday, G. Comparative method in education. New York: Holt, Rinehart and Winston, 1964.

[7] Callahan, D. Pegido, B. Educating experienced IT professionals by addressing industry's needs, IEEE Software, Vol. 19, No. 5, pp 57-62, 2002.

[8] Cavana, R. Y. Delahaye, B. L. Sekaran, U. (2001) Applied Business Research: Qualitative and Quantitative Methods, John Wiley & Sons, Brisbane.

[9] Davis, S. Siau, K. Dhenuvakonda, K. Virtual extension: a fit-gap analysis of e-business curricula vs. industry needs, Communications of the ACM, Vol. 46, No. 12, pp 167-177, 2003

[10] Durlabhji, S. Fusilier, M. Ferment in business education: e-commerce master's programs, Journal of Education for Business, Vol. 77, No. 3, pp 73-98, 2002.

[11] Etheridge, H. L. Hsu, K. H. Y. Wilson, T. E. E-business Education at AACSB-Affiliated Business Schools: A Survey of Programs and Curricula, Journal of Education for Business, Vol. 76, No. 6, pp 328-331, 2001.

[12] Forrester Research (2005). US IT investment in Q3 2005: strong despite hurricanes' impact. <http://www.forrester.com>

[13] Fusilier, M. Durlabhji, S. No downturn here: tracking e-business programs in higher education, Decision Sciences Journal of Invovative Education, Vol. 1, No. 1, pp 73-98, 2003.

[14] Granitz, N. Hugstad, P. Creating and Diffusing a Technology Champion Course, Journal of Marketing Education, Vol. 26, No. 3, pp 208-225, 2004.

[15] Grönroos, C. Relationship approach to the marketing function in service contexts: the marketing and organization behavior interface, Journal of Business Research, Vol. 20, No. 1, pp 3-11, 1990.

[16] Hoffman, D. L. Novak, T. P. Marketing in hypermedia computer-mediated environments: conceptual foundations, Journal of Marketing, Vol. 60, pp 50-68, 1996.

[17] ITAA (2001). When can you start? Building better information technology skills and careers. Outlook for the IT Sector, <http://www.itaa.org>

[18] Kassarjian, H. H. Content Analysis in Consumer Research, Journal of Consumer Research, Vol. 4, pp 8-18, 1977.

[19] Kennewell, S. Morgan, A. Factors influencing learning through play in ICT settings, Computers & Education, Vol. 46, No. 3, pp 265-279, 2006.

[20] Krovi, R. Vijayaraman, B. S. E-commerce content in business school curriculum: opportunities and challenges, The Internet and Higher Education, Vol. 3, pp 153-160, 2001.

[21] Lal, K. Determinants of the adoption of e-business technologies, Telematics and Informatics, Vol. 22, pp 181-199, 2005.

[22] Lee, S. K. (2005). CIOs expect steady growth in tech sector hiring. Robert Half Technology, <http://www.roberthalf.com>

[23] Marketing Intelligence Center (2005), IT expenditure in Taiwan SME. <http://mic.iii.org.tw>

[24] Mechitov, A. I. Moshkovich, H. Olson, D. L. The Master's Degree in E-commerce: A Survey Study, The Journal of Computer Information Systems, Vol. 42, No. 4, pp 29-34, 2002.

[25] Novitzki, J. E. E-business Education: A Comparison of Graduate Programs and Curricula, IS2002Proceedings of the Informing Science + IT Education Conference, Cork, Ireland, June 19-21, 1187-1196, 2002.

[26] Pinker, E. J. Seidmann, A. Foster, R. C. Strategies for transitioning old economy firms to e-business, Communications of the ACM, Vol. 45, No. 5, pp 77-83, 2002.

[27] Stohr, E. A. Introduction to special issue on IS curricula and pedagogy, MIS Quarterly, Vol. 19, No. 3, pp 49-51, 1995.

[28] US Bureau of Labor Statistics (2005), Occupational Employment Projections to 2012. Retrieved April 13, from

<http://www.bls.gov/opub/mlr/2004/02/art5full.pdf>

[29] Weber, R. Some implications of the year-2000 era, dot-com era and offshoring for information system pedagogy, MIS Quarterly, Vol. 28, No. 2, pp 3-12, 2004.