Global Knowledge Network

by

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Abstract

The convergence of Digital Economy, Globalization, and Knowledge-based Economy, creates the potential for Global Knowledge Networks and e-Knowledge Commerce. "The e-knowledge markets will grow to be a $1 trillion global micro-economy by 2010," estimated by Kaieteur Institute For Knowledge Management in 2000. The next wave of growth is likely to be associated with E-Knowledge Commerce, far exceeding the E-Commerce. However, up to date, significant disconnections exist among Digital Economy, Knowledge-based Economy, and Globalization. e-Knowledge Commerce is too new to have business models to exist in either the business world or literatures.

This thesis tries to fill this significant gap, by focusing on a new type of global institutional development, known as Global Knowledge Network, by defining its characteristic features and formulating the relevant 'best business models.' More specifically, this thesis (a) determines and formulates business models relevant for different types of e-Knowledge Commerce, and (b) explores how to develop the functionality of a Global Knowledge Network such as Global System for Sustainable Development (GSSD) in the context of e-Knowledge Commerce.

Furthermore, this thesis examines the policy and legal issues in e-Knowledge Commerce & Global Knowledge Network, such as intellectual property right, customer privacy, digital trusted system, security such as firewalls, encryption, watermark, etc. Finally, draws conclusions about e-Knowledge Commerce & Global Knowledge Network and provides some recommendations for further research work.

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Global Knowledge Networking
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Introduction

In the last ten years, US economy has generated a record about the longest prosperity in history, which exceeded many estimates by business and economists. As Federal Reserve Board Chairman Alan Greenspan said: "...our nation has been experiencing a higher growth rate of productivity—output per hour—worked in recent years. The dramatic improvements in computing power and communication and information technology appear to have a major force behind this beneficial trend." The breakthrough and application of Information Technology especially the Internet created the "Digital Economy." Furthermore, the Internet has grown to be a global network, which accelerated the globalization to include all the countries into the "Digital Earth."

Simultaneously, as pointed out in OECD report *The Knowledge-Based Economy*, including USA, "The OECD economies are increasingly based on knowledge and information. Knowledge is now recognized as the driver of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance." Therefore, there is a convergence of Digital Economy, Globalization, and Knowledge-based Economy, which creates the potential for Global Knowledge Networks and E-Knowledge Commerce. According to Kaieteur Institute For Knowledge Management in 2000, "the e-knowledge markets will grow to be a $1 trillion global micro-economy by 2010."

However, up to date, significant disconnections exist among Digital Economy, Knowledge-based Economy, and trends in Globalization. For example, most of the commodities in E-Commerce/Digital Economy are tangible goods, the ones that are generally operated and distributed by conventional transportation systems (e.g. UPS). But, the systems used for tangible goods are not applicable to intangible goods such as knowledge. Knowledge can be transferred in digital forms at the speed of light as much as 0.3 million km/second, thus creating new and unfathomed opportunities for trade. Developments such as these give E-Knowledge Commerce great potentials in the overall development of the global economy and of the Global Knowledge Network. The next

wave of growth is likely to be associated with E-Knowledge Commerce, both in the conventional and digital economies.

Although there are millions of papers about E-Commerce, unfortunately, few works have been done about E-Knowledge Commerce through Global Knowledge Network. E-Knowledge Commerce is too new to have business models to exist in either the business world or literatures.

This thesis tries to fill this significant gap, by focusing on a new type of global institutional development, known as Global Knowledge Network, by defining its characteristic features and formulating the relevant 'best business models.' More specifically, the purpose is to (a) determine and formulate business models relevant for different types of E-Knowledge Commerce, and (b) explore how to develop the functionality of a Global Knowledge Network such as Global System for Sustainable Development (GSSD) in the context of E-Knowledge Commerce.

Since the origin of Digital Era is commonly defined by the development of the Internet, **Chapter 1** begins with a brief history of the Internet and E-Commerce, followed by Knowledge-based Economy, which gives the necessity and possibility for Global Knowledge Network. Then, by carefully scrutinizing the conventional E-Commerce models, the argument of this thesis is introduced that E-Knowledge Commerce business models are fundamentally different from E-Commerce models.

Chapter 2 first discusses the overview of Global Knowledge Network. Next, Knowledge Market, E-Knowledge Commerce and relevant functions in the Global Knowledge Network will be discussed and an effort is made to establish the business models for different types of E-Knowledge Commerce: e-learning, e-Publishing & Digital Library, e-Sale of Software, e-Conferencing, e-Consulting, and National Innovation System in e-world. With the development of wireless Internet, in the coming future, Global Knowledge Network can provide services such as 4A: Anytime, Anywhere, Anybody, Anyknowledge.

Chapter 3 discusses Global System for Sustainable Development as a case study. Furthermore, the Global Knowledge Network will be customized to meet the demands of developed countries, emerging markets and developing countries respectively, discussing the similarities and differences between them.

Chapter 4 discusses the economic models of E-Knowledge Commerce, how the Global Knowledge Network create/add value to its users from an economic perspective.

Chapter 5 talks about the legal issues in E-Knowledge Commerce, such as intellectual property right, customer privacy, digital trusted system, security such as firewalls, encryption, watermark, etc.

Finally, **Chapter 6** draws conclusions about E-Knowledge Commerce/Global Knowledge Network and gives recommendations for further research work.

Chapter 1. The Internet, E-Commerce and Knowledge-based Economy

Section 1.1 A Brief History of the Internet

The Internet has revolutionized the computer and communications world far exceeding the invention of the telegraph, telephone, radio, and computer, which is one of the most successful examples of the benefits of sustained investment and commitment to research and development of information infrastructure. Beginning with the early research in packet switching, the government, industry and academia have been partners in evolving and deploying this exciting new technology.

During the history of the Internet, there is the technological evolution that began with early research on packet switching and the ARPANET, and where current research continues to expand the horizons of the infrastructure along several dimensions, such as scale, performance, and higher level functionality. There is the operations and management aspect of a global and complex operational infrastructure. There is the social aspect, which resulted in a broad community of *Internauts* working together to create and evolve the technology. And there is the commercialization aspect, resulting in an extremely effective transition of research results into a broadly deployed and available information infrastructure.

In 1961, Leonard Kleinrock in MIT wrote the first paper about packet-switching (PS) theory by. In next year, J.C.R. Licklider & W. Clark introduced the *Galactic Network* concept encompassing distributed social interactions. In 1965, TX-2 at MIT Lincoln Lab and AN/FSQ-32 at System Development Corporation (Santa Monica, CA) are directly linked (without packet switches) via a dedicated 1200bps phone line; Digital Equipment Corporation (DEC) computer at ARPA later added to form "The Experimental Network." In 1969, ARPANET was commissioned by DOD for research into networking, with four nodes in UCLA (30 August, hooked up 2 September), Stanford Research Institute (SRI) (1 October), University of California Santa Barbara (UCSB) (1 November) and University of Utah (December).

In 1970, C.S. Carr, S. Crocker, and V.G. Cerf authored the first publication of the original ARPANET Host-Host protocol. And Network Control Protocol (NCP), the first host-to-host protocol, was used by ARPANET hosts. First cross-country link was installed by AT&T between UCLA and Bolt Beranek and Newman, Inc. (BBN) at 56kbps, which was later replaced by another between BBN and RAND. A second line is added between MIT and Utah. Ray Tomlinson of BBN invents email program to send messages across a distributed network in 1971. In 1973, the first international connection to the ARPANET was established with University College of London (UK). Bob Metcalfe's Harvard PhD Thesis outlined the idea for Ethernet, which was tested on Xerox PARC's Alto computers, and the first Ethernet network called the Alto Aloha System. In this year, the number of ARPANET users was estimated at 2,000. In 1974, Vint Cerf and Bob Kahn published "A Protocol for Packet Network Interconnection" which specified in detail the design of a Transmission Control Program (TCP). BBN opens Telenet, the first public packet data service (a commercial version of ARPANET). In 1975, Satellite links were established cross two oceans (to Hawaii and UK) and the first TCP tests were run over them by Stanford, BBN, and UCL. In 1978, TCP split into TCP and IP.

In 1982, DCA and ARPA established the Transmission Control Protocol (TCP) and Internet Protocol (IP), as the protocol suite, commonly known as TCP/IP, for ARPANET. This leads to one of the first definitions of an "internet" as a connected set of networks, specifically those using TCP/IP, and "Internet" as connected TCP/IP internets. Also, DOD declares TCP/IP suite to be standard for DOD. In 1983, Name server was developed at University of Wisconsin, no longer requiring users to know the exact path to other systems. In 1984, Domain Name System (DNS) was introduced and the number of hosts breaks 1,000. In 1986, NSFNET was created with backbone speed of 56Kbps. In 1987, the number of hosts breaks 10,000, then reached 100,000 in 1989.

In 1990, ARPANET ceased to exist, and the World comes on-line (world.std.com), became the first commercial provider of Internet dial-up access. In 1992, the number of hosts breaks 1,000,000. In 1994, NSFNET traffic passed 10 trillion bytes/month and you could now order pizza from the Hut online (Zakon, 2000). Figure 1 depicts the main timeline of the history of the Internet.

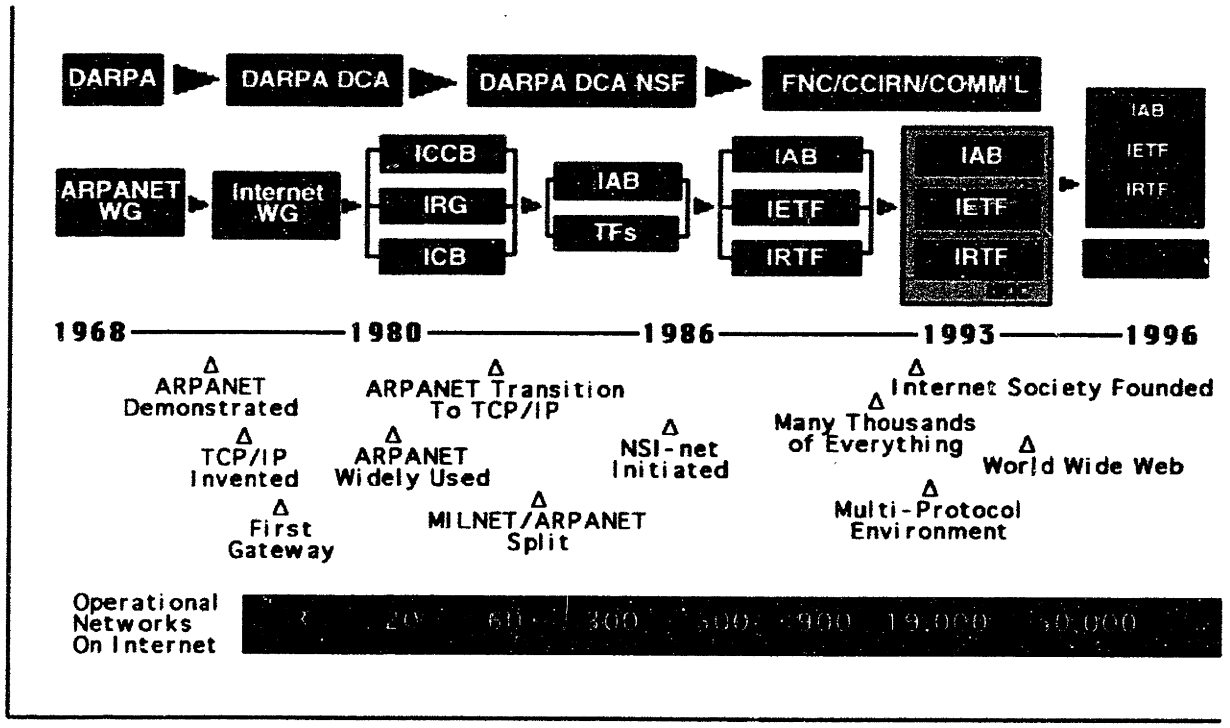

Figure 1 Timeline of The Internet

(Source: Leiner, et al, 1999, A Brief History of the Internet)

Section 1.2 Digital Economy

In the human history, no matter how great the inventions could be, at the beginning, the inventors almost couldn't imagine how significant application and influence could be resulted from the invention. So does the Internet. According to David D. Clark, in late 1970s, someone involved in the research of Internet mentioned the commercial application of the Internet. But no one had imagined the digital economy as much as trillions of dollars after decades.

In the early 1980s, commercialization of the Internet involved not only the development of competitive, private network services, but also the development of commercial products implementing the Internet technology. At that time, Dozens of vendors were incorporating TCP/IP into their products because they saw buyers for that approach to networking. Unfortunately they lacked both real information about how the technology was supposed to work and how the customers planned on using this approach to networking (Leiner, et al, 2000).

In 1985, recognizing this lack of information availability and appropriate training, Dan Lynch in cooperation with the IAB arranged to hold a three day workshop for all vendors to come learn about how TCP/IP worked and what it still could not do well. The speakers came mostly from the DARPA research community who had both developed these protocols and used them in daily work. About 250 vendor personnel came to listen to 50 inventors and experimenters. The results were surprises on both sides: the vendors were amazed to find that the inventors were so open about the way things worked (and what still did not work) and the inventors were pleased to listen to new problems they had not considered, but were being discovered by the vendors in the field. Thus a two-way discussion was formed that has lasted for over a decade (Leiner, et al, 2000).

After two years of conferences, tutorials, design meetings and workshops, a special event was organized that invited those vendors whose products ran TCP/IP well enough to come together in one room for three days to show off how well they all worked together and also ran over the Internet. In September of 1988 the first Interop trade show was born. Five thousand engineers from potential customer organizations came to see if it all did work as was promised. It did. Because the vendors worked extremely hard to ensure that everyone's products interoperated with all of the other products - even with those of their competitors. The Interop trade show has grown immensely since then and today it is held in 7 locations around the world each year to an audience of over 250,000 people who come to learn which products work with each other in a seamless manner, learn about the latest products, and discuss the latest technology (Leiner, et al, 2000).

The rapid development of the Internet can also be illustrated by the increment of host, as depicted in Figure 2. In only 20 years, the host increased from 213 in 1980 to 93,047,785 in 2000.

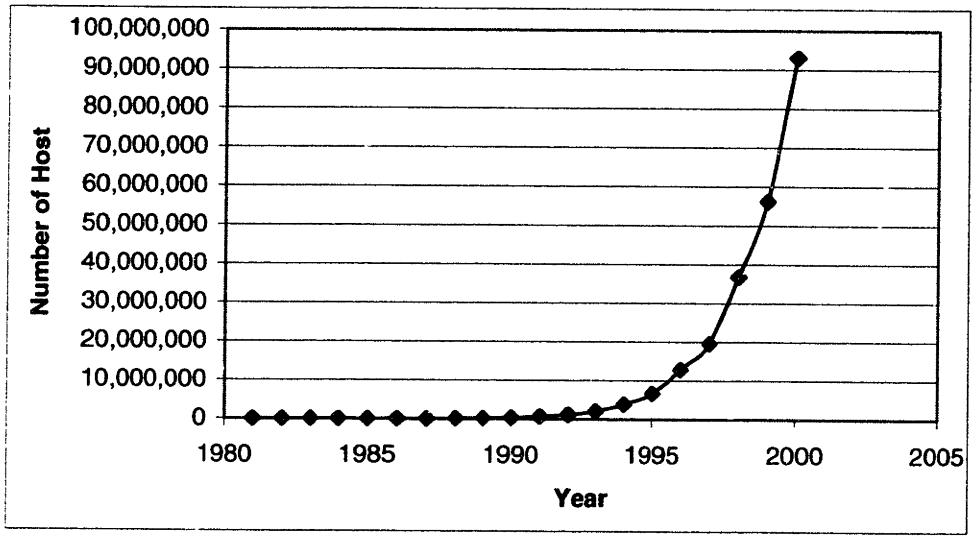

Figure 2 Host in the Internet

(Data Source: http://www.isc.org/ds/host-count-history.html)

In 1996, the Department of Commerce published the report *Emerging Digital Economy*, which is the first official report about the digital economy. Nowadays, the Internet is reshaping the global economy and digital economy is replacing the traditional economy as the core of the whole economy. The Center for Research in Electronic Commerce funded by National Science Foundation in University of Texas at Austin divided the Digital Economy Indicators into four layers:

- Layer 1 - The Internet Infrastructure Indicator
- Layer 2 - The Internet Applications Infrastructure Indicator
- Layer 3 - The Internet Intermediary Indicator
- Layer 4 - The Internet Commerce Indicator.

It is found that Layer 1 - The Internet Infrastructure Indicator generated $142.8 billion in revenues in the first half of the year 2000, including first quarter revenues grew 69.3 percent over the same quarter in 1999 and second quarter revenues increased by 57.4

percent. Layer 1 employed over 932,000 individuals at the end of the first half of 2000, with increment of 52 percent in the first quarter and 37.7 percent in the second quarter over the same quarter of last year. Layer 1 has the highest productivity of all the layers, reaching over $80,000 revenue per employee for the second quarter alone, which provides the platform for growth for the remainder of the Internet Economy. Furthermore, it is important to notice that many of the largest Internet Infrastructure companies contribute not only to Layer 1, but also generate significant E-Commerce revenues. In many cases, they also provide Layer 2 products and services.

The Layer 2 - The Internet Applications Infrastructure Indicator, involves software products and services necessary to facilitate Web transactions, as well as transaction intermediaries. In addition to the software products and platforms that help facilitate Web transactions, this layer of the Internet Economy includes the consultants and service companies that design, build and maintain all types of web sites, from portals to full E-commerce sites. While the output of this layer may not be tangible to the average user of the Internet, it is the fundamental basis for e-commerce and other functionality on the Internet. Layer 2 generated $72.8 billion in revenues in the first half of 2000, including first quarter revenues grew 62.3 percent in relation to the first quarter of 1999 and second quarter revenues increased by 51.9 percent over the same quarter last year. Layer 2 employed over 740,000 individuals at the end of the first half of 2000, increasing 57% from the same period in 1999.

A distinct type of company operates in Layer 3, one that is predominantly an Internet pure-play. Although not directly generating revenues from transactions, their Web-based business generates revenues through advertising, membership subscription fees, and commissions. Many of the Layer 3 companies are purely Web content providers, while others are market makers or market intermediaries. This is an important group of companies that is likely to have a significant impact over time on the efficiency and performance of electronic markets. Layer 3 generated $64 billion in revenues in the first half of 2000. The first quarter revenues grew 63.8 percent in relation to the first quarter

of 1999, while revenues increased an amazing 84.6 percent over the second quarter of last year. Layer 3 only hired a half million employment in the first half of 2000.

The companies included in Layer 4 - the Internet Commerce Indicator cross a wide variety of vertical industries, whose business model could be B to B, B to C, etc. Layer 4 generated over $127 billion in revenues in the first half of 2000, with the growth of 66.7 percent in the first quarter and 57.8 percent in the second quarter over the same quarters in 1999. The employment in Layer 4 is more than 1 million, 10 percent higher than those in 1999.

Totally, the Digital Economy provided an additional 612,375 jobs in the first half of 2000 and directly supported three million workers with an increment more than 20% over the same period of 1999, as demonstrated in Table 1. This employment surpassed the insurance industry (2.36 million workers) and the real estate industry (1.5 million).

Table 1 Digital Economy Indicators – Quarterly Employment Figures

	Quarter 1 2000	Growth over Q1 1999	Quarter 2 2000	Growth over Q2 1999
Layer 1 - Infrastructure Indicator	877,245	51.8%	932,484	37.7%
Layer 2 - Application Indicator	711,396	62.3%	740,673	51.9%
Layer 3 - Intermediary Indicator	457,876	5.5%	468,689	3.9%
Layer 4 - Internet Commerce Indicator	1,020,416	12.6%	1,033,159	8.2%
The Internet Economy (After removing overlap)	2,986,913	29.1%	3,088,497	22.6%

Source: Center for Research in Electronic Commerce, Graduate School of Business, University of Texas at Austin, © 2001

The Digital Economy reduces the transaction cost drastically and collects the employees and partners in a Digital Earth, accelerating the trend of Globalization. As in the following example, the AutoXchange connects all of the 30,000 Ford suppliers and 6,900

Ford dealers worldwide, facilitating Ford's annual purchases as much as $80 billion with its global suppliers.

Section 1.3 E-Commerce Models

Generally, E-Commerce is based on three main business models:

- **B – B:** Business began to use Internet for commercial transaction with their business partners since about 1996. Internet can improve productivity to buy parts, distribute and sell products and services, resulting into zero storage, cost cutting and time saving.

  For example, on Nov. 2nd 1999, the 2nd largest auto giant Ford and the network software and equipment giant Oracle announced the birth of the AutoXchange, an automotive joint venture to bring the supply chain to be online. All of the 30,000 Ford suppliers and 6,900 Ford dealers worldwide are eligible to use the AutoXchange service regardless of the size of their own network infrastructure. The venture facilitates Ford's $80 billion in annual purchases with its global suppliers and transactions involving a $300 billion extended supply chain. This creates the world's first automotive online supply chain network with billions dollars of transactions, which reconstructs both the auto industry and the E-Commerce among businesses. This new online automotive marketplace reduces drastically Ford's purchasing costs and increases its operating efficiencies through the integrated Internet supply chain. For example, Ford saved more than $10 million in its first auction using AutoXchange, in which the company made a $78 million production buy. Since companies spend 50% of their revenue on purchasing goods and services, a huge reduction in total purchase costs will make their profit soar, furthermore lifting their market value in the stock market. With the automating of the entire purchase process finally, it will extend Ford's core supply chain to consumers to reduce Ford's time to market, which is a critical competitive edge in the global auto market. In Feb., 2000, another Internet Giant Cisco was attracted to join Oracle and Ford Motor in supporting AutoXchange.

As the largest auto-maker, GM also formed its e-GM electronic-commerce unit earlier 1999, in an effort to expand its hi-tech. services and Internet capability. GM began building cars with build-in computers that allow access the Internet in 2000.

- **B – C**: This model exists mainly in the online retailing business, which means one company services to a large quantity of customers. Nowadays, online retailers such as Amazon.com sell various types of goods from books to cars. Customers search online at their home and order whatever they want, which will be delivered by UPS in a few days. Books, computers, etc. are the most popular commodities trading online.

- **C – C**: There are some sites focusing on auction. Some of the commodities are from individuals, as well as from business.

- **C – B**: Individual person can't provide something to a large number of Businesses in a large volume, since individual person has no facility to manufacture some tangible products in a large volume. If individual person can do this, he must convert to Business, hiring employees.

The E-Commerce business models are illustrated in Table 2.

Table 2 E-Commerce Functions and Business Model

	Tangible Goods	Example
B - B	**Yes**	Auto parts
B - C	**Yes**	e-retailing
C - B	**?**	?
C - C	**Yes**	Auction in small amount

Section 1.4 Knowledge-Based Economy

In 1996, Organization for Economic Co-Operation and Development published the milestone report *The Knowledge-Based Economy*, which is the first official recognition of the Knowledge-Based Economy by main industrialized countries. OECD said in this

report, "The term *knowledge-based economy* results from a fuller recognition of the role of knowledge and technology in economic growth. Knowledge, as embodied in human beings (as *human capital*) and in technology, has always been central to economic development. But only over the last few years has its relative importance been recognized, just as that importance is growing. The OECD economies are more strongly dependent on the production, distribution and use of knowledge than ever before. Output and employment are expanding fastest in high-technology industries, such as computers, electronics and aerospace. In the past decade, the high-technology share of OECD manufacturing production and exports has more than doubled, to reach 20-25 percent. Knowledge-intensive service sectors, such as education, communications and information, are growing even faster. **Indeed, it is estimated that more than 50 percent of Gross Domestic Product (GDP) in the major OECD economies is now knowledge-based."** (OECD, 1996, p. 5).

As a result, the convergence of Digital Economy, Globalization, and Knowledge-based Economy creates the potential for Global Knowledge Networks and E-Knowledge Commerce. According to Kaieteur Institute For Knowledge Management in 2000, "the e-knowledge markets will grow to be a $1 trillion global micro-economy by 2010."

However, for e-Knowledge Commerce, such as e-learning, e-Publishing & Digital Library, e-Sale of Software, e-Conferencing, e-Consulting, the business models are quite different from the E-Commerce Models. These differences are so fundamental as to warrant careful scrutiny in order to understand their full implications, as discussed in the next Chapter.

Chapter 2 Global Knowledge Network

This chapter will first discusses the overall of e-Knowledge Commerce and e-Knowledge Market. Next, the relevant types of will e-Knowledge Commerce be discussed and an effort is made to establish the business models for different types of E-Knowledge Commerce: e-learning, e-Publishing & Digital Library, e-Sale of Software, e-Conferencing, and e-Consulting, etc.

Section 2.1 e-Knowledge Market

With the development of knowledge-based economy, more and more intellectual property is produced. According to an estimate in *Fortune*, 2000, about $ 5 trillion in new intellectual property was generated worldwide in 1998. This is only one aspect of the world's expanding flow of ideas, expertise, and Intellectual Capital. The global education market is $724 billion currently, including K-12, post-secondary, college, and corporate training. Another relevant market is the supply and demand for human capital, including digital market-places for trading talent, work, jobs, professional services, projects, which is $700 billion currently (Davis, 2000).

The knowledge market is being reshaped by the diffusion of the Internet. In 1994, 3 million people were connected with the Internet, this number jumped to 62 million in 1997, and 100 million in 1998. In May 1999, there are 171 million people with access to the Internet. Furthermore, this number is expected to be 1 billion by 2005.

With the rapid diffusion of the Internet, more and more intellectual property and education are traded online, which is called "e-Knowledge Commerce," resulting into "e-Knowledge Marketplaces". "e-Knowledge Marketplaces are ultimately on-line venues, where sellers of intellectual capital and intellectual property can be matched with potential buyers, of such assets. These are digital community contexts, where knowledge-seekers can find knowledge-providers." (Davis, 2000, http://www.kikm.org/).

Due to the great potential of e-knowledge commerce, it is projected to be the next and much larger wave after e-commerce. According to the Kaieteur Institute For Knowledge Management, 2000, the global E-Knowledge Market will grow to be a $1 trillion global micro-economy by 2010.

Private companies already found the e-Knowledge Market is a huge gold mine. It is extremely impressive and compelling to see the individual entrepreneurs, angel investors, venture capital companies, and major corporations involved in e-knowledge marketplaces, such as:

- Individual Entrepeneurs
  Sabir Bhatia (co-founder of HotMail) - Arzoo.com
  Bill Gross (founder Of Idealab) & David Eisner - iExchange.com

- Angel Investors
  David Duffield, CEO Peoplesoft - IQ4Hire.com
  Ray Lane, Former President & COO, Oracle - IQ4Hire
  Kevin Clark, former CEO Modem Media Poppe
  Joe Kraus, Founder Excite@ Home - Infomarkets.com
  Reed Hundt, former Federal Communications Commission (FCC) Chairman – IP Network.com
  Craig McCaw, the wireless telecommunications pioneer - IP Network.com

- Venture Capital Firms
  Kleiner Perkins Caufield & Byers -iExchange.com
  Wit Capital - Expertcity.com
  Bulldog Capital Management - Infomarkets.com
  Caryle Venture Partners - Inforocket.com
  Draper Fisher Jurvetson - Inforocket.com
  - Workexchange.com
  Prospect Street Ventures - Inforocket.com

Benchmark Capital - Keen.com

Vulcan Ventures Inc (ie *Paul Allen*) - Keen.com

Softbank Corporation - Pl-x.com

Bessemer Ventures - Exp.com

@Ventures (a CMGI affiliate) - Exp.com

Accel Partners - HelloBrain.com

Brentwood Venture Capital - HelloBrain.com

Knowledge Universe (*Michael Milke*n) - eMind.com

- Major Corporations

AOL - Infomarkets.com

IBM (with partner Internet Capital Group) - Delphion IP Network

Microsoft - Keen.com

Andersen Consulting - Ventius.com

JP Morgan - Experts-exchange.com

Sun Microsystems - Expercity.com

Bertelsmann - Expertcity.com

ZDNet - Expercity.com

New York Times (New York Times Digital) - Abuzz.com

eBay - Keen.com

The Proctor & Gamble Company -Yet2.com

Honeywell International - Yet2.com

Go2Net (Disney) - Askme.com

Oracle - Exp.com

Information Holdings Inc - Patex.com

The Motley Fool - Soapbox.com

Intel - HelloBrain.com

Price Waterhouse Coopers -IPEX.net (Davis, 2000).

The importance of E-Knowledge Market is recognized not only by private companies, but also by government. For instance, the Dutch Government realizes that while Holland

is a world leader in the global market for flowers, other regions around the world can mount a challenge to their dominance. The solution that's clear to the Dutch, is that it is their horticultural *knowledge* that will keep them pre-eminent. They have been nurturing pilot e-knowledge exchange market collecting centers of horticultural knowledge in Holland as a tool that can keep their market leadership strong. With this e-knowledge exchange market, all the flower farmers in Holland can get access to the advanced knowledge about flower cultivation and latest information from the global flower market.

With the development of global e-knowledge market, a couple of business models are being invented for e-knowledge commerce, such as e-Learning, e-Publishing, Digital Library, e-Software, e-Conferencing, e-Consulting, e-Patent Licensing, e-Knowledge Auction, e-Knowledge Stores or Malls, Stock Market or Investment Knowledge Exchanges, Community Oriented or Social Capital Oriented e-Knowledge Markets, Human Capital Exchanges, etc., which represent various e-knowledge markets, which will be discussed in details in the following sections.

Section 2.2 e-Learning

In the past two centuries, with the development of Industry Revolution and Moderation, school learning became popular. In this new century, as the knowledge-based economy develops, knowledge and learning are becoming increasingly central to work and life in everyday. This trend is accelerated drastically by the diffusion of the Internet, which generates more demand for learning knowledge and more supply of knowledge, beyond the conventional boundaries of age, time and classroom. Therefore, among the various e-knowledge markets, the e-Learning market is the one that is developing most rapidly. E-learning, emerging around the end of 1996, is actually a new twist on an old one: Computer-based training (CBT), which is much more costly. As discussed above, the global education market is $724 billion totally, including the large e-business train market.

Business e-Learning Market

Since the explosion of knowledge and the rapid update of professional skills, almost all the professionals need to be trained to keep in traffic. For example, Motorola said, they will no longer hire engineers with a "four-year degree", but rather, a "forty-year degree". One the other side, it is well-known that developing a good environment for learning is important for the retention and recruitment of talented employees.

In 1997, the Conference Board conducted a survey about training in the Business Week 1000 (Top 1000 companies in the U.S.). The survey were mailed to the senior human resources (HR) executives and senior training and development (T&D) executives at the companies, with the addition of the interviews with the T&D executives on the best practices at the leading Conference Board member companies. Totally, there were 315 executives responded to the survey, including 159 HR executives and 156 T&D executives, representing the companies with average 39,000 employees each and 5 million employees totally in almost all industries. In the survey, 97 percent of respondents "agree" or "strongly agree" that the significant of training at their companies will increase in the future. For example, Ford Motor Company has a technical staff of 25,000 professionals that are expected to undertake 40 hours of training each year. Because the training is becoming more and more important to the success of the companies, the corporate universities are emerging rapidly. In 1988, there were about 400 corporate universities, this number increased to more than 1000 in 1997. More than 40 percent of Fortune 500 companies have implemented a corporate university.

According to the survey, it is generally recognized that leadership development is the most important type of training and technical training is the second. There are also other types of training, such as supervising skills, senior management, teamwork, customer services, quality improvement, career development, communications training, etc.

New performance technologies offer more methods to conduct training other than conventional classroom. Some of these new technologies are: computer-based training via local area network; computer-based workshops for groups who can complete a

module together and then discuss it; video servers that permit the use of video courses on demand on PS; satellite broadcasts that are available on desktops; conferences via the Web; and World Wide Web learning resources, etc. Among these methods, the most promising one is e-learning, or online leaning.

In 1997, there were only less than 20% of companies employed e-learning, but most of the other 80% companies said they would use it in the next 12 months (http://www.infoworld.com/). For instance, industry giants such as Chrysler, Ford, GM, American Airline all use e-learning. More than 3,000 employees had been trained online in Aetna since November 1997, and in 2000, this number is tripled. Intel Inc. has more than 20 main locations around the world, with 70 thousand employees. Intel's Channel e-learning Center was launched in Nov. 1998. In 1998, 11% of all Intel students took e-learning courses, while the percentage increased to 29% in 1999. "e-learning is one of Intel's competitive advantages." (Robert M. Jecmen of Intel Inc., 1999, http://www.onlinelearning2000.com).

The outsourcing of training is expected to increase, which means an increasing training market. Many companies are now joining forces to learn and share with each other. For example, Learnshare, Inc. is a consortium of large global companies that was formed to identify, share, and improve the best training of each member company. The consortium not only share training between the company members, but also acts as the coordinator the training services offered by outside providers. By leveraging resources and improving the quantity, quality, and availability of training, outsourcing and alliances can provide learning opportunities for more employees and improve the bottom line of each company (The Conference Board, 1997). With the developing of training market, there are more and more companies specially to provide training to other companies or individuals.

IDC conducted a survey with the target population as training managers, information system managers and business unit managers from companies that have used e-learning. According to the survey, nearly 100% of respondents said they would recommend e-

learning to companies that are not currently using it, and 60% said they would strongly recommend it. They said e-learning was flexible, convenient, and time- and cost-effective. IDC believes that the high rating of cost-effectiveness confirms that prices of e-learning courses are worthy and indicates that once customers absorb the early conversion costs, they are in a position to realize the significant saving from e-learning (http://www.idc.com/). Due to the multiple advantages of e-learning over conventional learning, e-learning is developing very rapidly, at an annual rate about 900% before 2002 (http://www.onlinelearning99.com/).

According to the Kaieteur Institute For Knowledge Management, 2000, the business e-learning market soars to be $80 billion. E-learning will become the largest delivery vehicle for corporate training and will soon enter the mainstream of training business activity. Currently, the market for healthcare is about $1 triillion, which is relevant to everyone. But, with the development of the knowledge-based economy, more and more persons need lifelong learning, so that the market of education including e-learning will exceed health care finally (Kaieteur Institute For Knowledge Management, 2000).

e-learning Offered by Universities

Facing the challenge from the e-learning companies, many traditional universities and colleges have also began to offer online education, such as Stanford University, University of California at Los Angeles (UCLA) and Indiana University.

Stanford University runs a synchronous, interactive course for a virtual community with the students as many as 1600 in 1998. UCLA set up OnlineLearning.net, which is the leading online supplier of continuing higher education and is dedicated to providing busy professionals with the tools needed to pursue their lifelong learning objectives. By combining technological innovation with extraordinary customer service, it is committed to helping adult learners around the world access the best in educational resources -- anytime, anywhere, for anybody at any stage in life.

In OnlineLearning.net of UCLA, there are more than 8,500 students enrolled from all 50 states and 64 U.S. territories and foreign countries. The number of courses is greater than 750 since September 1996, such as General Business Studies, Award in General Business Studies Concentration in Technical Communication, Concentration in Accounting, Concentration in Human Resources Management, Concentration in Personal Financial Planning, Cross-Cultural Language and Academic Development (CLAD) Program, College Counseling Program, Professional Designation in Personal Financial Planning Program. The courses received unparalleled satisfaction from student: Over 87% successfully complete their online courses offered through OnlineLearning.net; 89% say that the course software is easy to use; 85% rate online courses distributed by OnlineLearning.net "as good or better than face-to-face learning."; 90% say they are likely to take additional online courses distributed by the OnlineLearning Program of UCLA (http://www.UCLA.edu).

Besides the obvious time and cost savings, providing access over the Internet allows employees that travel frequently or live in remote areas to access high-quality education. "This program benefits the department by providing access that is not available in the immediate geographic area. The only issue we have to deal with is the requirements of the learning institutions, " said Error Modine, a manager at Lockheed Martine Missiles & Space, whose staff have taken Indiana University's e-learning (http://www.infoworld.com).

Advantages of e-Learning over Conventional Learning

As a totally new method for learning, e-learning has various advantages over conventional learning. According to a survey conducted in England, the primary advantages for using e-learning is to make training more accessible, followed by time and cost reduction. For example, in Ford Motor Company, the time for general training courses online is expected to be 30% less than the conventional courses, while still reach the equivalent learning gain. Ford has a technical staff of 25,000 professionals that are expected to undertake 40 hours of training each year for everyone. That means a total of 1,000,000 hours-employee effort to learn new process, which is indeed a substantial

commitment. By using e-learning instead of classroom-learning, it can save 300,000 hours-employee, equivalent to multiple million dollars (CIPD Annual Report, 2000). Currently, the course content in e-learning is primarily non-interactive resources such as papers, videos, tapes of lecture, etc. But, as the broadband becomes more and more popular, interactive virtual class will be the main stream of e-learning. The interactive virtual class includes the basic elements in conventional class, plus other perspective especially for e-learning, such as application-sharing: when instructors run a program on his computer, students can run and watch the whole process on their own computer. A student said, "I don't see any disadvantages to this type of learning. There is no time constraint, and the course material is very concise and straight to point. I don't feel like I miss anything by not being in a classroom. If I have a need, I can set up online conferencing to get additional help. " (http://www.infoworld.com/). Since the greatest advantage of e-learning is that it provides the rapid distribution of timely information, the main inhibitor to the growth of e-learning is the bandwidth limitations (http://www.ITTA.org/).

Great opportunities exist for e-learning, which can handle all the processes about training courses at a much lower cost. Information technology can accelerate the creation of new courses, also, software is available to translate the courses into multiple-languages. Furthermore, the infrastructure of global knowledge network based on the Internet or intranet in an international corporation can transfer the courses easily from its headquarter to its offices around the world.

Counting the Cost of e-Learning

How does the cost of e-learning compare to other methods of training for employees? Although it's hard to compare apples to apples, e-learning can reduce the expenses drastically, even without considering the costs of work lost and time wasted on commuting between office/home and training centers. Following is an example about the different costs of Java training courses provided by various colleges and e-learning centers.

ONLINE COURSE: Calcampus charges $65 for its Java class, with an on-time admission fee of $45, totally $110, which is the cheapest one among all the options followed.

COMPUTER-BASED TRAINING: Fees for CBT courses depend on annual licenses. For example, a Java-programming course can be obtained for $695 for a single user.

ON-SITE TRAINIING: Executrain, in Atlanta, offers two-day training courses for PowerBuilding and JavaScript programming. Taught on site with the host company providing the computers, both courses at a cost of $450 (PowerBuilding) and $640 (JavaScript programming).

OFF-SITE TRAINIING: The Seale Group, in Atlanta, offers off-site training courses taught by instructors to a small class averaging nine students per session. The training is taught during a three-day period. The cost for Java training is $950 per student.

COLLEGES: A 5-hour course at Georgia Institute of Technology costs $295. The average cost for a course at an Atlanta community college is $160. These costs don't include the cost for room, travel to college, etc. (http://www.inforworld.com)

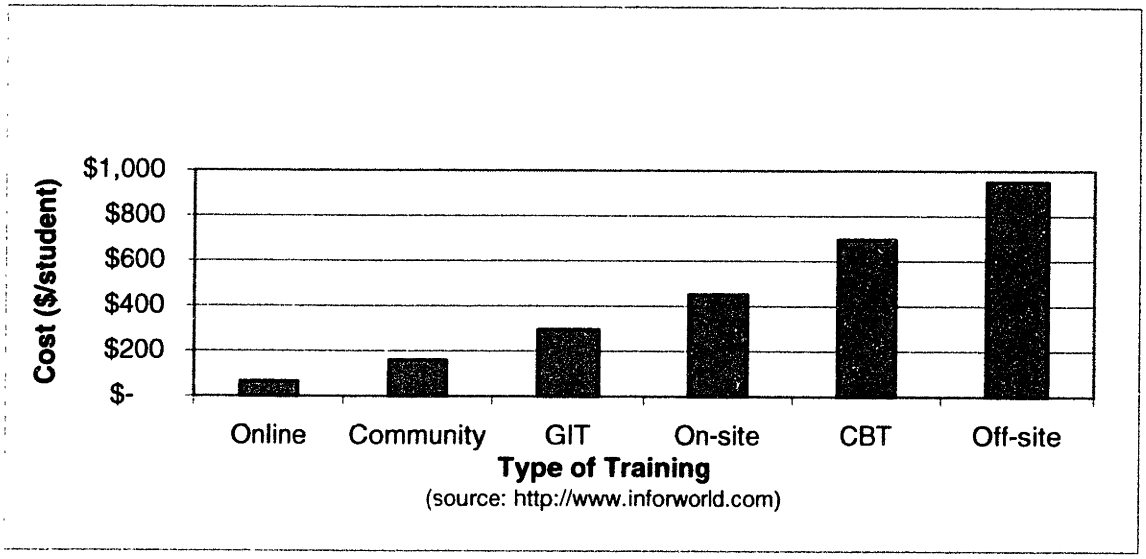

Figure 3 Cost Contrast (a java training course as an example)

In Figure 3, the large gap exists between e-learning and other education. Hence, MCI WorldCom saved $5.6 million over conventional learning in 1998 (Robert M. Jecmen from Intel Inc., 1999).

Higher Performance of e-Learning:

Also, e-learning has better performance than conventional learning. There are two experiment conducted by Center for Innovation in Product Development (CIPD) in MIT. In the experiments, each class participants are divided into two groups. In the first experiment, one group of students took e-learning, the other group took conventional classroom class. It was found that:

1. The e-learning group performed statistically better than the conventional group. As illustrated in Figure 4, the average grade of e-learning group is higher than the conventional group;
2. When combined with experimental learning, off-loading certain materials to the web can yield significantly improvements in learning rates;
3. Because different people learn differently, supporting diverse styles yields improved effectiveness;
4. Experimental learning provides significant motivation for learning (CIPD Annual Report, 2000).

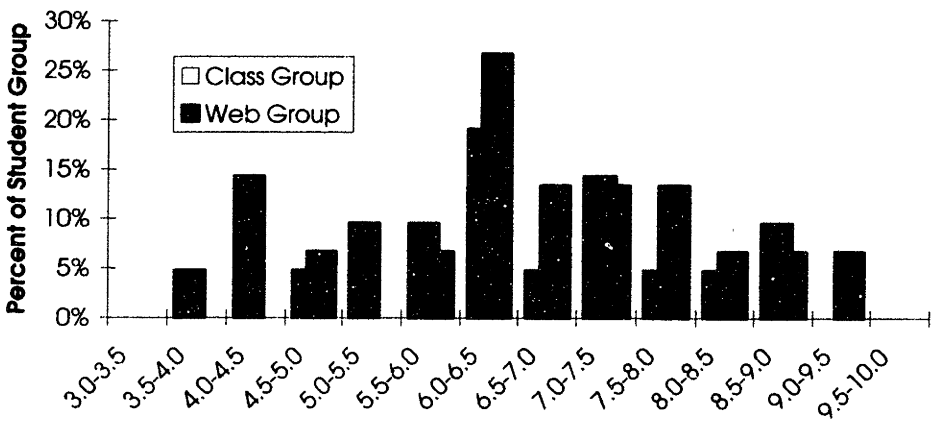

Figure 4. Grade on Visual Prototyping Assignment after Experimental Lecture
(Average grade difference 7.3%, CIPD Annual Report 2000)

In the second experiment, both group were exposed to the web-based courseware that delivered material ordinarily presented in the classroom. Students in one group prepared for class using the web-based materials and then received a lecture in classroom, covering the main topics as ordinary classes (web + class lecture). Students in the other group prepared by the same web-based materials, but directly work with faculty on illustrative examples that utilized only a small portion of the subject matter (web + limited experience). Then the students all completed the same assignment on the same subject matters. As illustrated in Figure 5, the average grade performance of the web + limited experience was 10.8% higher than the web + class lecture group. Statistically, evidence of only 0.001 is significant enough to reject the hypothesis that the two groups performed equally. This finding suggested that if materials are delivered online, the time for conventional class lecture can be liberated for potentially higher value-added activities such as mentoring and experimental activities (CIPD Annual Report, 2000).

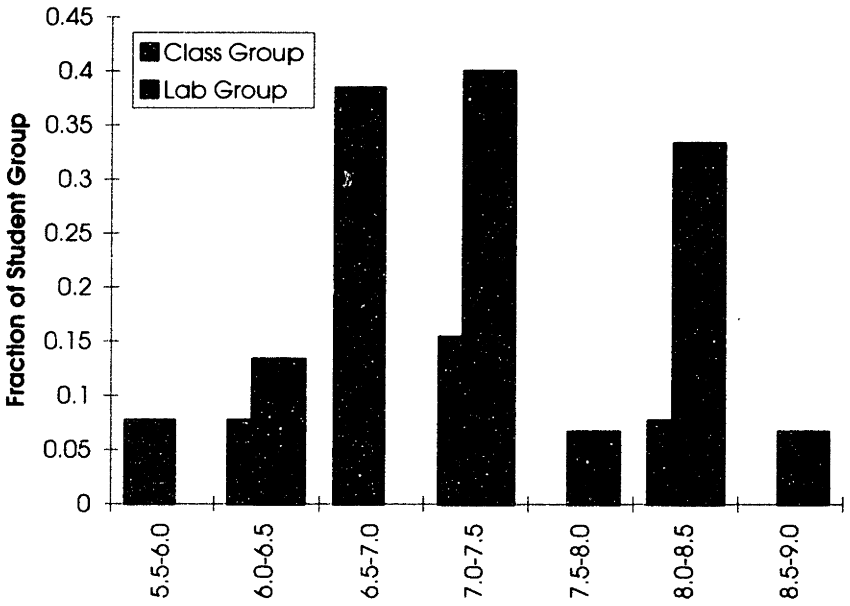

Figure 5. Performance on Assignment after Experimental Lecture (Average grade difference 10.8%, CIPD Annual Report 2000)

Return of Training

According to the survey conducted by the Conference Board, 1997, 44 percent of T&D executives who said their companies measure the value of training, the primary reason for doing so is "being a strategic partner". Other top reasons include:

- Result of rapid and continuous change. Nowadays, the technology and business world are developing so rapidly, the only way to keep on track is to continue training the employees with the updated technology and skills. Otherwise, the company will be out of date and beaten by the small companies who are good at catching the emerging technology and the market accompanied, e.g., Amazon.com is beating Brick-bookstores and even Wal-Mart.

- Pressure to control costs and overhead. The cost of training is very high. Without checking the result of training, the companies probably trash money into the black hole. Thus, measuring the return of training can lead companies to emphasize on the efficient training program and cut others, so that they can maximize the ROR of training.

For decades, research has been conducted to study how best to evaluate the effectiveness of training. Return of training includes the improvement of productivity, employees' satisfaction of job, morale, etc. The current standard for training evaluation is the Kirkpatrick Model, which was established 40 years ago. Kirkpatrick's four levels of evaluation are:

1. Reaction: trainee reaction to training intervention.
2. Learning: understanding of the subject taught, generally demonstrated by pre- and post- course examinations.
3. Behavior: application of what was taught: changes on the work.
4. Results: the impact on business results (increased sales, fewer errors, etc.).

ROI measure and Kirkpatrick's level 3 and 4 measures (behavior and results) are used most often with technological training, since that type of training is easier to measure. While, leadership skills as the most important and expensive area of training, are the hardest ones to measure (The Conference Board, 1997).

Considering the return of training, a study of manufacturing firms found that companies with formal training programs experienced a 19 percent greater rise in productivity over

three years than those without such program. Motorola Inc. spent $120 million on education in 1992 - 3.6 percent of its payroll. Motorola claimed that every $1 spent on training delivered $30 in productivity gains within 3 years. The company has cut the costs by $3.3 billion by training employees to simplify processes and reduce waste. Sale per employee doubled in five years and profit increased 47 percent. The United Auto Workers/Ford Education Development and Training Program - a joint effort in education, training, and worker empowerment—raised employees' job satisfaction ratings to 75 percent. This program also increases productivity at Ford by 36 percent by 1980 (The Conference Board, 1997).

Although the Kirkpatrick Model is widely accepted in the training area, it is rarely implemented – only 51 percent of the companies in the survey used it. As one HR executive said, "The Kirkpatrick Model does not always fit today's business. It is outcome-based and does not account for other nontraining factors that influences the performance." Also, it's difficult to differentiate among the many factors that may contribute to the improvement of morale or production, etc., and the product of training is too intangible to be measured quantitatively.

According to the survey, the main roadblocks for companies to measure the value of training were "too many variables"(23 percent) and "no consensus on the definition of value" (20 percent). Other blocks included lack of knowledge of how to measure value, lack of line management commitment, cost issue, lack of senior management commitment, and poor understanding of the training functions (The Conference Board, 1997).

Therefore, only 36 percent of the companies in the survey have training department staff members dedicated to measuring training effectiveness. Only 44 percent of the T&D executives and 24 percent of the HR executives said that their company measures the ROI in training. Instead, they were measuring to meet line management's business goals and to improve the design and delivery of training (The Conference Board, 1997).

Technical Models for e-learning

As illustrated, there are several options for the customers to get access to the virtual classroom, as depicted in Figure 6. One is the dial-up method, which is very popular right now. But, the problem is that the speed is low and the telephone is occupied for the class. Another option is Asymmetric Digital Subscriber Line (ADSL). ADSL transmits about 6- 9 Mbps to subscribers and 16 – 640 kbps in two ways. ADSL creates three channels for customers: a high-speed downstream channel for customers to download video from the e-learning center, a medium-speed duplex channel for interactivity with the instructor or classmates, and a basic telephone service channel which let the customers or its family members can still contact outside while he staying in virtual classroom for one or two hours.

The third generation of wireless telecommunication (3G) lets the customers to surf online by mobile phone, which means wireless Internet. 3G can let anybody to get access to e-learning center at anytime and anywhere. For students in groups, Polycom.com provides a series of VideoStaion for the online conferencing. VideoStation has an IP address to connect to the Internet and can convert the digital signals into analogue signals which can be displayed on the conventional TV, with the quality as the cable TV.

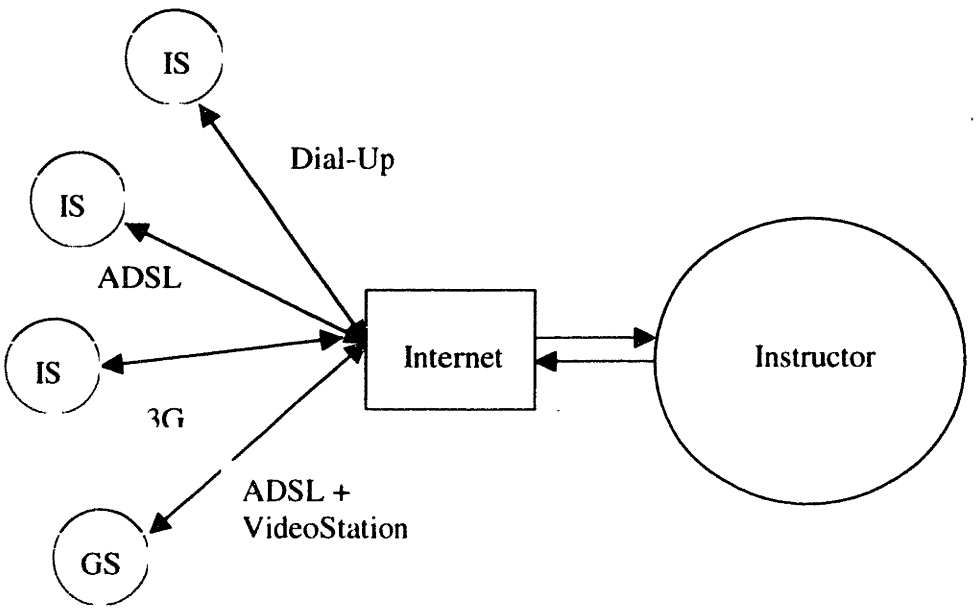

Figure 6. One Instructor to Many Students Individually or in Groups
IS: Individual Student GS: Students in Group

There are four main categories/levels of technologies/devices for e-learning, according to the capabilities. Since the technologies and devices evolve continuously, there is no significant gap among them. Usually, the higher level covers the functions on the lower level.

1. Basic: This category has the simplest functions for e-learning. The student has the browser-based software to get into the classroom online, watching the instructor and the whiteboard by Realplayer, and post questions on the forum. Also, the student can ask questions and hand in assignments or quizzes by email. On the level, there is only text interactivity with one way of voice or video.
2. Standard: On this level, there are more functions, including those on basic level. There are text interactivity, voice interactivity threw Internet telephone, video interactivity through VidoeStation, which is one kind of video camera specially for Video Conferencing.
3. Deluxe: Broadband Internet provides high speed for text, voice and video interactivities with high quality. The learning management systems are available for students and instructors. Some advanced systems even have a knowledge robot which acts as a teaching assistant. There are databases for student files, for frequently asked questions (FAQ), for quiz and examinations, etc.
4. Wireless Virtual Campus (4A: Anybody Anytime Anywhere Anyknowledge): This level is related to the 3rd generation of wireless telecommunication, as wireless Internet. The customer can take classes at anytime and anywhere in the virtual campus, with full text, voice, and video interactivity. Actually, the online center merges with online consulting center and online knowledge center. When customers meet problem in work or life, they can immediately ask questions to the e-learning center (online consulting / knowledge center).

Synchronous E-learning

In e-learning, there are two main types: synchronous and asynchronous e-learning. In synchronous learning, students attend virtual classrooms when human instructors are giving lectures, with live interactivity between instructors and students. Asynchronous learning is students' self-paced. Students watch the video recorded from synchronous

learning, read the textbook, and send emails to ask questions, etc., without live interactivity between instructors and students. Comparing the performance of synchronous and asynchronous e-learning, implements with high interactivity but low-medium complexity (e.g. text and graphics) are generally more successful than those with high complexity but low interactivity.

There are a couple of synchronous hardware/software packages designed by companies to fulfill the functions at different levels. The synchronous packages consist various features as below:

1. **Pre-session Content Distribution**: Some learning materials such as hand out, software or video can be sent to the students' computers before class, which can save time for class and improve interactivity.
2. **Discussion Board**: The discussion board provides the basic function of e-learning: Text Interactivity, which is similar to any forum online.
3. **Shared Whiteboard**: The difference of whiteboard and discussion board is that in addition to text, the instructor and students can post images or diagram on it.
4. **Application View/Sharing**: The feature that allows two or more persons in different locations to work together in a single live software application. In application sharing, one user launches the application and it appears on all participants' computers simultaneously. Both users can input information and control the application using the keyboard and mouse. Although it appears that the application is running on both PCs, it actually is running on only one. The instructor who launched the application can lock out students from making changes, so the students watch the application running but cannot change it. The instructor can illustrate or share the application with the students, which is very helpful for the courses about Information Technology or design.
5. **Audio**: The voice interactivity can be realized by Internet telephone, and the relevant software is free to download or is already combined in the device.
6. **Video**: The video interactivity is the critical function to enhance from the basic level to standard level in e-learning. There are two categories of device for individual student and group students. For individual student, RealNetworks'

Realplayer is available to display the video from the instructor. Actually, some students will feel more comfortable, if they can't be watched by the instructor or classmates, especially when they take class at home. If they are sensitive about their privacy, they just need Realplayer to watch the instructor without video camera pointing themselves. For students in groups, Polycom.com provides a series of video cameras (VideoStation) for e-learning and video conferencing. "ViewStation is the first videoconferencing system to include an embedded Web server and Web-based integrated presentation system. This unique architecture allows system management, diagnostics and software upgrades to be accessed anytime, anywhere (http://www.polycom.com/). This device is very suitable for group e-learning.

7. **Hand-Raising, Yes/No Button and Polling**: This is also two-way interaction. When some of the students want to ask questions, they can click on the Hand-raising button, all the names of the askers will appear on the screen of the instructor's monitor. Once the instructor chooses one and clicks on his name, his channel will be open and his voice can be heard by all the instructor and students. If the instructor asks if the students understand one topic or not, the students can click on Yes/No button. The answers are immediately sent to the screen of the instructor's monitor and counted automatically. Therefore, the instructor can make decision to let the students to ask questions and explain it more or continue the class, according to their feedback. The instructor can conduct instant poll online and get the results displaying in diagram, which also let the instructor to gauge the students performance at once and make adjustments if necessary.
8. **E-book and online Publishing:** All the textbooks and handout are distributed through online publishing system. Students can print them out or download into their e-books devices (details about e-book and its copyright will be discussed in e-Publishing following).
9. **Homework, Quiz and Examination**: Most of the homework, quiz and examination can be designed to be convenient to be graded automatically, especially in IT training courses. The self-paced quiz can help the students to check their progress by themselves.

10. **Databases**: In the system, there are a couple of databases for the students' files, courses, textbooks, quizzes, and examinations. Also, there can be a database for the FAQ , which come from the students questions and can save the time to avoid repeating answers.
11. **Record and Playback**: There will be live class with instructor once in everyday and the lecture will be recorded. Then, out of the class time, the lecture will be edited and played again, for students to review and those who missed the live class. This also frees the instructors to prepare and improve new lectures.
12. **e-learning Management System and Knowledge Robot:** E-learning Management System (ELMS) takes care of all the elements discussed above and keep them operating smoothly. ELMS should be omniscient and omnipresent, with the new functions of language translation, quality control, credit-royalty management, etc. At the core of this system, there are Knowledge Robots (knowbots), which are intelligent software agents that automate the repetitive tasks of human facilitators in e-learning.
13. **Teaching Assistant**: The online teaching system is so technology-intensive that it probably will be too complicated for the instructors who focus on the content of lectures. Additionally, it is too heavy to require the instructors to manage both the lecture and the technology system, even if they are familiar with the system. Therefore, a teaching assistant is necessary to take care the system and part of the teaching duty. The teaching assistant need to be familiar with both the class and e-learning system, including both device and software (http://www.astd.org/).

There are live classes with instructor in everyday and all the lectures, which is synchronous and is recorded. Then, out of the class time, the lecture will be edited and played again, for students to review and those who missed the live class, which is asynchronous.

Asynchronous Leaning and Knowledge Robot

Usually the cost or time constraint limits the possibility of the attendance of human tutor at anytime when asynchronous learning is available. The students usually feel they are

learning by themselves alone without live interactivity between the students and the instructors, which resulting into that the rate of completion or student retention is very low in the asynchronous e-learning. There need to be a facilitator to communicate with the students and provide aid when necessary. In asynchronous e-learning, the students ask questions and want answers immediately. One possible solution is to introduce the knowbots.

There are several characteristics of a knowbot:

1. Self-starting: Be activated by the questions from students, or any other stimulus from the environment.
2. Continuity: Since the knowbot is used to take the role of the human instructor, the knowbot should be on duty 24 hours per day and 7 days one week, for the convenience of any students who want to learn from any locations around the world.
3. Collaborative: Provide accurate and helpful answers upon requirement immediately; don't reply questions blindly, modify or ask clarification if the original question is not clear; if can't answer the question, provide possible suggestions and references.
4. Active: In addition to respond to the demand from the students, the knowbot will encourage and remind learners to attend the class on time, complete and hand in the assignment, etc.
5. Communication ability: The knowbot can contact databases, other knowbots or instructors for sufficient knowledge and help, by email or even voice mail.
6. Flexible: There may be schedule, but it will not restrict the action of the knowbot. It should understand the demand or any changes in the environment and decide the response.
7. Personality: A knowbot should be designed to act as a human teaching assistant. The students will not know it is a TA or a knowbot answering his questions.
8. Adaptability: The knowbot can improve its action by learning from its previous experience to help the students better. For example, knowbot can keep on

recording all the FAQ & answers and refining them to be very accurate after a while (http://www.aln.org/).

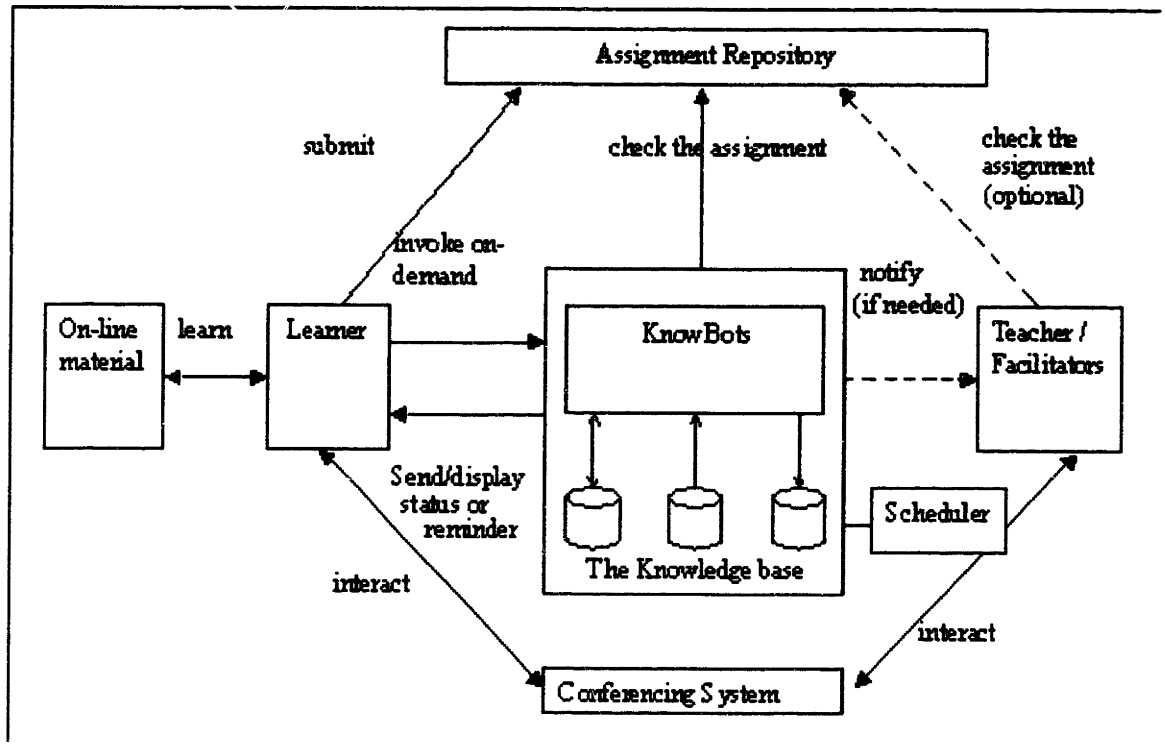

Figure 7. General Architecture of Knowbot System
Source: http://www.aln.org/

FAQ database and email the learners to hand in old assignments or distribute new assignments, etc. The interactivity between instructor and students can be realized through conferencing system.

To find how much the knowbot can improve the asynchronous e-learning, Thaiupathump et. al. at Vanderbilt University conducted an experiment in 1998 and 1999. The control group has 220 participants in May 1998, while the experiment groups have 98 participants in September 1998 and 64 participants in January 1999 respectively.
All the three groups took an eight-week online workshop, with the same content. The only difference among them was that: the experiment groups were helped with a knowbot, while the control group not. It was found that adopting knowbots improved the e-learning significantly. For example, the average completion rates of assignments

increased by about 50%, and the average number of posting per student (one index that students are active in the workshop) increased by about 60%. One of the most important reasons is that students can get reasonable feedback from the knowbot immediately and encourage them to continue. Therefore, knowbot is a very strong motivator to the learners without the attendance of human instructors or TAs. The human instructor can be exempted to take more creative duties, such as design new courses, improve the textbook, etc.

According to the survey conducted in England, respondents answered they learn online in the following times in a day: during the normal working hours, slack periods/downtime, lunch and other break periods, or outside work hours. Plus the fact that students distributed around the world, this means that the e-learning center has to keep on open for the convenience of any students, which is a great opportunity for the application of knowbots. To study the economics about e-learning with knowbots, one case study is introduced as following: For one e-learning center, there are 100 courses with 100,000 students taking classes simultaneously. The e-learning center opens 24 hours per day and 7 days a week for the convenience of any students around the world. In order to attract students and become leader in this emerging market, the competitive edge is to provide the full services with high quality as discussed above, including answering questions at once. There are only two options that can provide such services: human teaching assistants and knowbots. Since the technical staff is the same in two options, only the differences are discussed. For 100 courses, even one TA can take care of three relevant courses, there should be 33 TAs per shift (8 hours), and 100 TAs per day. With these 100 TAs in weekdays, it's necessary get more TAs for the weekend. Totally the salary will be about $3,000,000 or more.

Although one knowbot is designed to take care all of these, two same knowbots are assigned in this system. Each knowbot is in charge of half of the tasks, and communicate the other knowbot. In case of one knowbot crashed, the other will automatically take care all the tasks and send emergence signals to the human manager and technical staff. According to the researchers in Media Lab in MIT, this kind of knowbot will cost about

$100,000 each, including software and device. Contrasting to the cost of human TAs, it can save a lot by using knowbots.

Besides the knowbot discussed above, there are other types of knowbots available: Posting Knowbot, Course Review Knowbot, Basic HTML Knowbot, Homepage Features Knowbot, Topic Knowbot, Multimedia Knowbot, DiscussionBuilder Knowbot, etc. They can also be categorized into scheduled, on-demand and submission helper knowbot. All these knowbots can be combined and customized to fit different duties in the e-learning centers.

More generally, intelligent agents range from the task as email filter to air traffic control, which is large, complicated and critical. In 1997, an intelligent agent drove a car from east coast to west coast, with only 5% of the mileage controlled by human driver. Similarly, it is possible for intelligent agents to help human beings driving on the information highway. Right now, intelligent agents are more and more popular in e-commerce, such as helping customers shopping. With the help of intelligent agents, you can create even your personal digital library online. The intelligent agent can look for the relevant paper, books, etc. to update and extend your library automatically.

Currently, the customers can get online through the Wireless Application Protocol (WAP) mobile phones or i-mode in Japan. The customers can type or speak short simple commands to the phone, and the intelligent agents will complete the complicated tasks. For example, NQL Solution, a division of AlphaServe.com, provides the service that customers can create agent-based applications by WAP phone. This means that e-learning center and personal digital library can be reached by anyone at anytime and anywhere, with the help of intelligent agents (http://www.botspot.com).
The utilization of robots raises another question, which is so horrible: Is it possible the robots can control or hurt the human beings? The Three Laws of Robotics is necessary for human being to design and use robots:

"1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.

2. A robot must obey orders given by human beings except where such orders would inflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First and Second Law." (Isaac Asimove, 1942, pp.59-61).

Section 2.3 e-Publishing and Digital Library

Right now, the publication industry in U.S. is $750 billion, including books, magazines, journals, etc., twice as much as telecommunications ($300 billion) and airlines ($355 billion) in size. In 1998, the size of Digital Economy in USA was about $301.4 billion. If all of publications convert to online publishing, Digital Economy will soon surpass health-care industry as $1 trillion (IDC, 1999).

Book publishing has changed dramatically over the past decade, with the advent of superstores, national wholesalers, electronic pre-press, and the Internet. These changes demand that book publishers to be knowledgeable and effective in all aspects of their operations - from production, to distribution, to publicity. The next decade will see even greater changes, even a revolutionary is coming to publishing.

Conventional Publishing Models

In past centuries, the conventional business model of publication is illustrated as Figure 8. After authors write books by themselves or upon the request of publishers, publishers ask printing factories to print many copies and send books to brick bookstores, where customers visit physically and buy books.

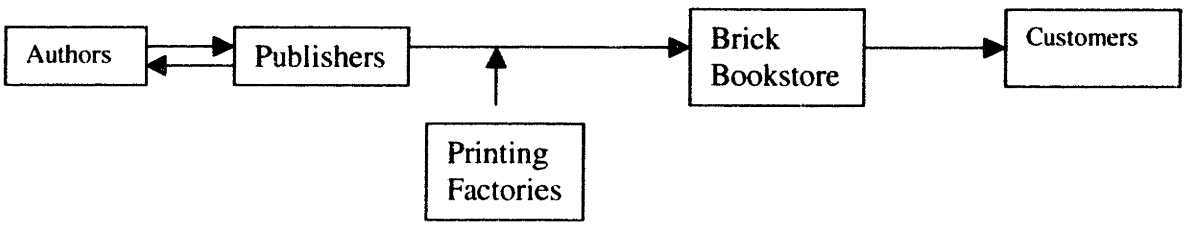

Figure 8. Conventional Publication System

Online Bookstore Model

Currently, the conventional business model of publication has been changed a little by online bookstores, as illustrated as Figure 9. After authors write books by themselves or

upon the request of publishers, publishers ask printing factories to print many copies and send books to online bookstores, which have large book categories & database and many huge distribution centers around the country or the world, storing these books. Once customers visit the online bookstores and pay by credit card, the books ordered will be sent to customers by UPS in one day or weeks.

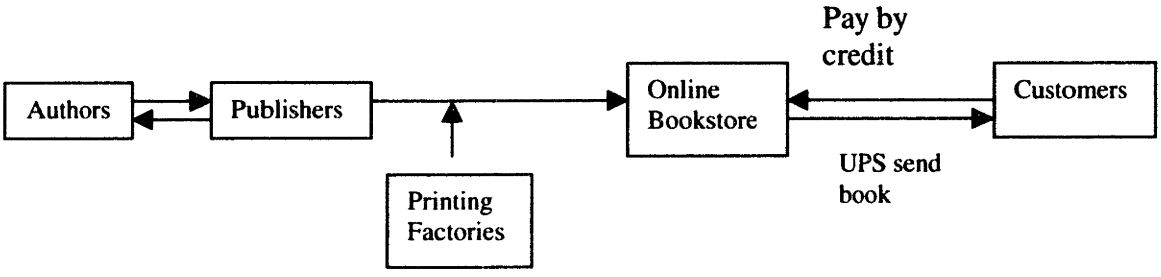

Figure 9. Current Publication System (Online

A Case: Amazon.com

Amazon.com is the current hottest online bookstore, which is a suitable case study to analyze the advantages and disadvantages of current business model and develop new model. Amazon.com opened its doors in July 1995 with a mission to use the Internet to transform book buying into the fastest, easiest, and most enjoyable shopping experience.

Today, Amazon.com is the huge e-department store to find and discover anything customers want to buy online. There are more than 29 million people in more than 160 countries visiting this leading online shopping Website. Amazon.com lists more than 28 million unique items in categories such as electronics, kitchen products, books, music, DVDs, videos, camera and photo items, toys, software, computer and video games, tools and hardware, lawn and patio items, and wireless products. Among Amazon family, there are Internet Movie Database (www.imdb.com), with more than 250,000 movies and entertainment programs; Drugstore.com, an online retail and information source for health, beauty, wellness, personal care, and pharmacy; Ashford.com, an online retailer of luxury and premium products offering new and vintage watches, fragrances, leather accessories, sunglasses, and writing instruments; eZiba.com, a leading online retailer of handcrafted products from around the world, at www.eziba.com.

Amazon.com announced that cumulative customer accounts, including Auctions users, increased by 2.4 million during the third quarter to 13.1 million at September 30, 1999, an increase of more than 190 percent from 4.5 million customer accounts at September 30, 1998. Repeat customer orders represented more than 72 percent of orders during the quarter ended September 30, 1999, up from 70 percent in the previous quarter (http://www.Amazon.com)

Net sales of Amazon.com for the fourth quarter of 2000 were $972 million, an increase of 44 percent over net sales of $676 million in the fourth quarter of 1999. For the year ended December 31, 2000, net sales were $2.76 billion, a 68 percent increase over 1999 net sales of $1.64 billion.

"We've evolved a great deal in five years, and in 2000 we learned a tremendous amount about the operating characteristics of our model, while improving our bottom line each quarter of the year," said Jeff Bezos, Amazon.com chief executive officer. "That learning, combined with even more hard work, positions Amazon.com to profitably serve customers better than ever." Gross profit for the fourth quarter of 2000 was $224 million, an increase of 155 percent over the prior year. Pro forma operating loss for the fourth quarter of 2000 was $60 million, or 6 percent of net sales, compared to a pro forma operating loss of $175 million, or 26 percent of net sales in the fourth quarter of 1999. While net sales grew 44 percent for the quarter, inventory declined 21 percent from the prior year to $175 million, reflecting improvement in asset turnover. "While the strength of consumer spending remains uncertain, and there are no guarantees, we expect Amazon.com as a whole to reach operating profitability in the fourth quarter of this year," said Warren Jenson, Amazon.com chief financial officer (http://www.Amazon.com).

One of the main reasons for this lost is the high cost to establish and maintain logistics and distribution centers around the country and the world. Many employees spend time to receive books, maintain storage, mail books, etc., whose salaries are a heavy burden for the company. How can Amazon.com handle this?

Order-Print Model

There is a model that the publication industries think about currently: order-print, as illustrated as Figure 10. After authors write books by themselves or upon the request of publishers, publishers print a few copies and send books to online bookstores, which have large book categories and database. Once customers visit the online bookstores and pay by credit card, the books ordered will be printed and mailed to customers by UPS in two days or one week.

However, either the online bookstore model or order-print model still is inconvenient: delay for customer to get the book once they pay. At Amazon.com, the best thing is this:

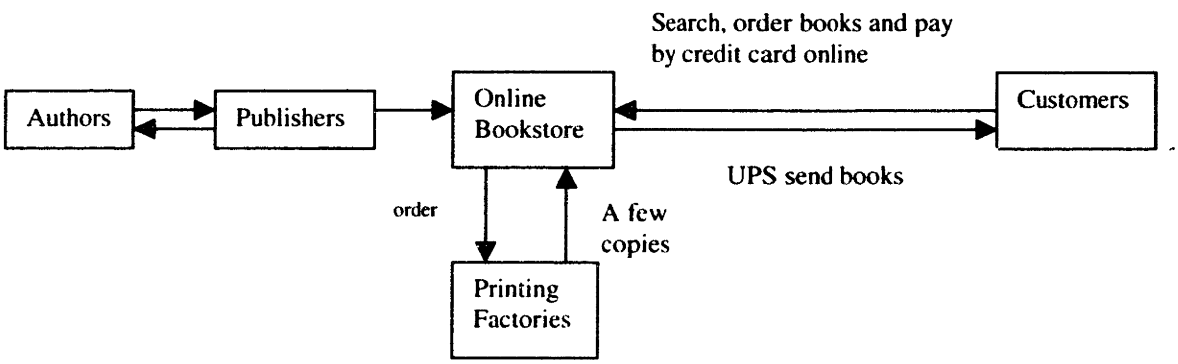

Figure 10. Tomorrow Publication System (Order - Print)

"Availability: Usually ships within 24 hours."

But for some books, it is said like this:

"Availability: This title usually ships within 4-6 weeks. Please note that titles occasionally go out of print or publishers run out of stock. We will notify you within 2-3 weeks if we have trouble obtaining this title."

Or even worse:

"Availability: This title is out of print. Although it is no longer available from the publisher, we'll query our network of used bookstores for you and send an update within one to two weeks.

Ordering Out-of-Print Books From Amazon.com is...

• Easy! Just place an order by adding the book to your Shopping Cart and proceed through the order form.
• Quick! We'll search for a used copy and send an order update within one to two weeks.
• Risk-Free! When we locate a copy of your book, we'll send a price quote. We'll attempt to acquire the book only after you confirm your wish to purchase.
Note: We don't search for a specific binding or edition, but rather for a copy of this title by this author. Each out-of-print book in an order is billed and shipped separately." (http://www.Amazon.com)

Waiting for 24 hours, or several weeks to get a new copy, or even weeks to be asked if you want to buy a used book, customers can lose their patience. How can someone treat customers like this in an Internet Era, in which the data are transferred at the speed of light as 30,000 km/second! Customers need their books once they pay for it!!

There are more serious problems in these conventional publishing models. Since publishing today is 95% marketing, it's very hard to determine which book will succeed in the market. The market is so competitive that the hundreds of major royalty publishers in the United States have now consolidated down to only 7 houses! The commercial publishers often reject the special-interest books, because the potential profit is fuzzy. Six million manuscripts are submitted to the annually ~ only 1% of them or 60,000 new titles are actually printed each year! There are approximately 570 literary agents in this country. An agent generally takes a minimum of 15% commission, but without one, you won't even get in the door of a royalty publisher! Average rejection rate for books submitted to literary agents is close to 98%! Of 10,000 children's manuscripts submitted ~ only 3 get published! Of 4,000 novels submitted ~ only 1 gets published (http://www.bookpublishing.com/). From the data above, it's astonished to see how many books even potential best-sellers are trashed by the conventional publishing models.

Online Publishing Models

These problems can be solved and authors, customers & publishers can be all satisfied by using **online publishing: pay-download/print**. In the near future, the business model of publication will be totally revolutionized by online publishing: pay-download/print, as illustrated as Figure 11. After authors write books by themselves or upon the request of publishers, publishers send it to the online book display center, which has immense book categories and database, and post the book abstract. Once customers search in the display center, find what they want and pay by credit card, the books can be downloaded and printed at once.

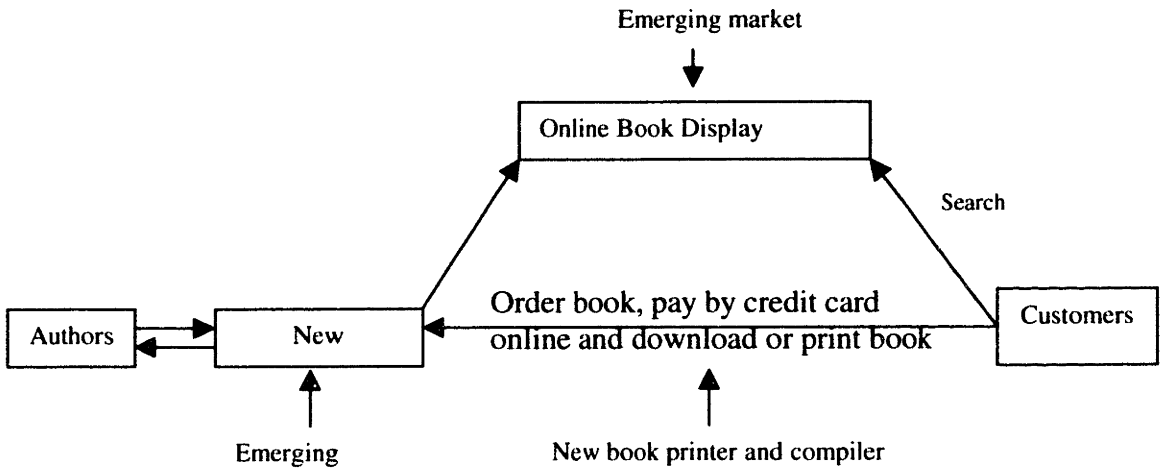

Figure 11. Future Online Publishing System A (Pay - Download)

There are several advantages in this model:

1. For customers, there is no wait, no out of print, no dirty books damaged on the way and needed to be returned. Customers can get a totally new book at once and feel very safe, which is very important for customers to shopping online. The cost of books will include only royalty, tax, online display fee, profit for publishers, etc., and the costs of print and paper are considered by customers themselves. Therefore, the total cost of publication is very low, and the prices of books to customers will always less than that of the physical counterparts, which will in turn attract more customers and enlarge the market.

2. For companies, there is no need to build and maintain huge distribution centers and logistics system for books, and no need to hire millions of employees to receive books, maintain storage, mail books, etc. Companies like Amazon.com can reduce its operating cost drastically and enjoy its profit at the first time. Actually, if Amazon.com doesn't follow this model and change its role, it could become out of business and vanish as soon as it appeared.

3. For authors, this model can lower the barrier to publish their books to zero. Since the cost to produce a format is very high, the more copies the lower cost for each copy. From the very beginning of publication, the barrier is pretty high to those authors who have not been recognized and have no publications before. Authors have to think about the cost before writing their books, "Is it possible for me to publish it after I finish it? If impossible, no need for me to write it." The publishers also have to worry about "Can this book be accepted by the market? How much do I have to print at the first version? I'll lose my money or make profit from it?" However, in the model of online publishing, there is no need to worry about such questions. Authors are encouraged to write, and publishers are encouraged to publish, since cost and risk are reduced to be ignorable.

   There are other advantages to authors in this model. It often takes a commercial publisher 18-24 months to publish a book. While, the author can publish his book online as soon as he finishes it. Usually, when an author used to sign a contract with a commercial publisher, they can forget about the book when they don't think they can make more money from it. In this model, authors will keep on controlling their books and making decision to sell part or all of their books at any time, or keep the right forever. Large commercial publishers pay only 5 to 15% of royalty, since its high publishing cost. But, authors can get most of the profit by online publishing. The commercial publishers and their stockholders are always interested in the profit, however, the largest excitement to authors is to put his name on books and share their knowledge and ideas with others who also are interested in.

4. The low price of books will encourage customers to buy more books, who have been scared by the high prices for a long time. The low cost of publishing will encourage authors to write more books. The volumes of books online published will far exceed that of conventional publication, which means the publication market will be much more prosperous. This is very good for public benefit, more and more ideas, theories, thinking and knowledge can be recorded and distributed more easily, constituting an important component of knowledge-based economy.

The advantages of the online publishing model stimulate the increasing of e-journals, as illustrated in Figure 12. The number of e-journals soared from 7 in 1991 to 1049 in 1997. In one day Stephen King sold 400,000 paperless copies of *Riding the Bullet* (Ditlea, 2000). Just a little searching on the Web finds a growing e-book industry: hundreds of online publishers and online bookstores. The e-publication market will reach $20 billion in the coming years.

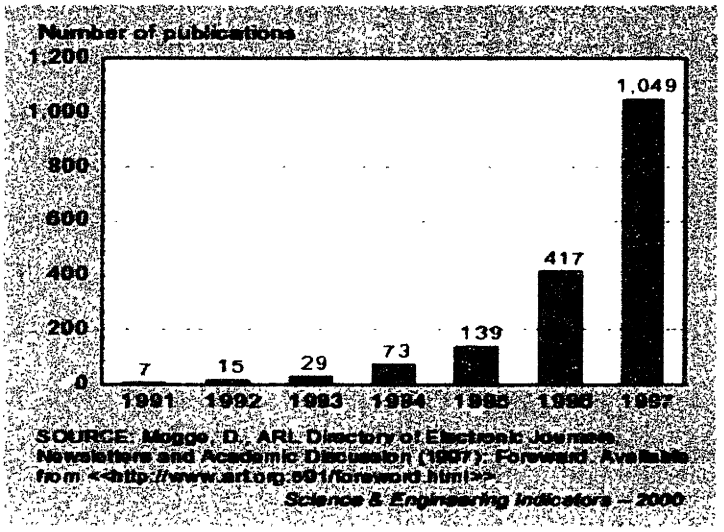

Figure 12. Growth of e-Journals

There are several emerging markets around this:

1. New publishing companies or publishing consulting companies: These publishing companies have experts about writing, publishing, copyright, marketing, management, etc. They help (potential) authors to handle everything to write and

publish a book, which the author doesn't know. They can help author from idea, outlines of book, manuscript, to revision, cover design of book, applying ISSN number, etc.

2. Online Book Display Centers: These centers can have several functions: just display books, or customers can pay and download books from here. The revenue can come from several resources: payment from customers, fee from publishers, advertisements, etc.
3. e-Book: The first digital book dated back to 1971 when Michael Hart was given a virtually unlimited account of computer time on the mainframe at the Materials Research Lab at the University of California. In 1990, Voyager Co. introduced the first e-book to be read on personal computers. But these diskette-borne works, including *Jurassic Park* and *Alice in Wonderland*, were never offered by other publishers. Basically, e-books are electronic reading devices dedicated to book length manuscripts. The advent of the Web brought both opportunity and distraction for e-books. As the first universal publishing medium, the Web could make e-books easily accessible, with its Hypertext Markup Language (HTML). But HTML's orientation toward short documents was hardly optimized for book-length texts. With more than 100 million Acrobat readers already downloaded onto computers, PDF became the de facto standard for e-book publication. In the last year or so, the term "e-book" has been appropriated by companies selling portable gadgets whose sole purpose is to display electronic texts. Currently, there are more than more than 150 e-book-only publishers, e-only bookstores, e-book trade publications online, even e-book best-seller lists (Ditlea, 2000).
4. Book printers, compilers and paper: For customers to conveniently download the large volume of books, this need brand width Internet. Also, new printers and compilers special for books are quite necessary, so that the books got in this way can be even better than the books from conventional printing factories. Right now, there are various size of books. In this model, the printers should be designed to be flexible for different size paper, or the books have to be fixed to only a few standard size. Also, there will be new market for new paper suitable for printing books with

different versions at home or office. The bad news is for printing factories, they will have no books to be printed.

There is another model similar to the previous one, as illustrated in Figure 13. In this model, online publishers have their own Online Book Display Centers. Customers finish all transactions with online publishers, including search, order, pay, download books.

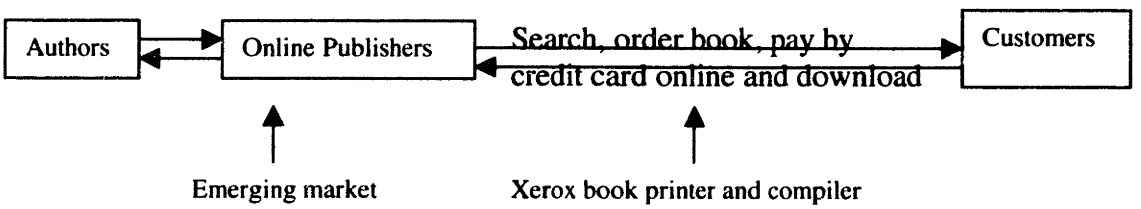

Figure 13. Future Online Publishing System B (Pay -

There is another business model, which is more revolutionary, as illustrated in Figure 14. In this model, there is no publishers at all, authors write papers or books then post on their own Websites or Online Book Display Centers, while customers search, pay to the authors by credit card, then download and print the books directly. If some authors don't know how to do it, they can get help from consulting companies about publishing.

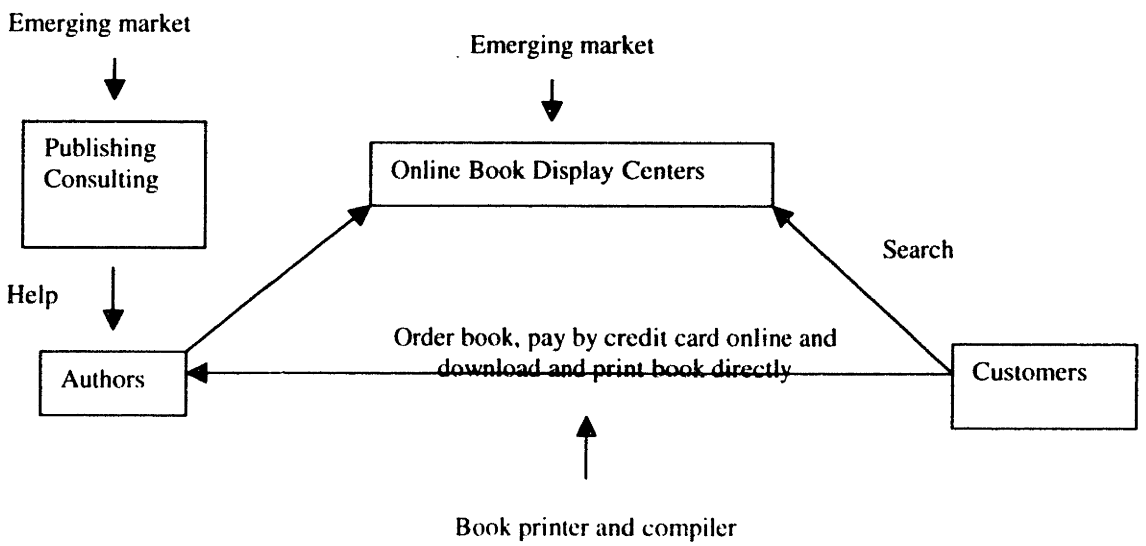

Figure 14. Future Online Publication System (Author-Customer)

In the near future, all the business models discussed above will exist simultaneously, while it will take online publishing a long time to totally substitute the conventional publishing. This progress depends heavily on the expansion of Internet to every country, every house and every office, and the improvement of Internet quality to fast download and print. Online publishing will be one of the main engines of Digital Economy. However, problems always accompany with opportunities. Next, if we also consider the digital libraries, we can find big problems about copyright to be thought about.

Digital library

"The concept of a 'digital library' is not merely equivalent to a digitized collection with information management tools. It is rather an environment to bring together collections, services, and people in support of the full life cycle of creation, dissemination, use, and preservation of data, information, and knowledge." (Santa Fe Workshop on Distributed Knowledge Work Environments, 2000, pp.27-29.)

When compare both online books display center and digital library, it can be found that physically they are almost the same: a large database containing digital books. When people read books in digital library, can they download/print what they are reading? If they can, they get a copy of the book free, the copyright of the author is hurted. If they can't, it's unconvenient for readers who like the book and try to buy one copy for themselves. The only solution can be this: combine online books display center and digital library together. According to the authors or publishers, different part of the book can be read by the customers online free, then customers decide if they want buy one copy at a minimal price. For example, for the author who writes his first book and worry about if his book will be accepted in the market or not, probably he would like to let much content of the book can be read online free. For the famous and established author, probably only the name of the author and the abstract of the book are sufficient for customers to decide to buy it or not.

But, this combination raises another problem. Historically, books in libraries are always free for public to borrow and read. If all the digital libraries change into this way, they

will be under crossfire from public. But, if every book, new or old, in digital libraries is free for public, what's the compensation to the authors' hard working? Or, like patent, the copyright of a book will expire in five or ten years. After the protected period, it's free to public. Also, there is problem about technology safety: It's easy to set a barrier to prevent readers to download a book freely, but it's also not difficult for hacker to break this barrier. If the bank is broken by the hacker, the digital books will flood out at the speed of light. All of these problems and dilemmas have to be solved before this model prevails.

Section 2.4 e-Rent Software and ASP

As discussed in e-learning and e-publishing, it is a heavy burden for instructors or authors even the .coms to purchase, maintain and update the expensive state-of-art IT systems for e-learning and e-publishing. This problem is very common in the new industries such as e-learning, e-publishing, etc., which create a new market for IT outsourcing.

IT outsourcing is the transfer of components or large segments of an organization's internal IT infrastructure, staff, processes or applications to an external resource provider. It ranges from the most rudimentary to the most sophisticated IT infrastructure, processes or applications. For instance, there are three main subgroups in the IT outsourcing market:

Application Outsourcing (AO): Providers manage and maintain software applications. ***Application Service Provider (ASP)*** and ***Application Maintenance Outsourcing*** are sub-sectors of the AO market. Table 3 summarizes the major differences. One important distinction is the actual ownership of the application. The ASP is the newest concept emerging from the foundation established in the outsourcing market. The ASP remotely hosts and delivers a packaged application to the client from an off-site, centralized location. The client does not claim ownership of the application but instead "rents" the application, typically on a per user basis. In Application Maintenance Outsourcing, providers manage a proprietary or packaged application from either the client's or provider's site (Cherry Tree & Co., 2000).

Table 3.Characteristics of Application Outsourcing

Sub-Sector	Ownership of Application(s)	Location of IT Assets/Application	Location of IT Support	Type of Application(s)
Application Maintenance Outsourcing	Client	Client or Provider	On- or off-site	Proprietary or Packaged
Application Service Provider (ASP)	Provider/Third Party	Provider	Off-site	Packaged

Source: Cherry Tree & Co., 2000

Information Utilities and Business Process Outsourcing (BPO): Providers focus on economic and efficient outsourcing solutions for complex but repetitive daily business processes. These could be as sophisticated as finance and accounting business functions or more repetitive processes, such as disbursements and payroll. The provider assumes all responsibilities associated with the entire business process or function (Cherry Tree & Co., 2000).

Platform IT Outsourcing: Providers offer a range of data center services, including hardware facilities management, onsite and offsite sup-port services, server-vaults and data security and disaster recovery capabilities. These relationships typically involve the transfer of IT facilities, staff or hardware.

During these typical IT outsourcing, ASP is the most popular model. An ASP, in its simplest form, is a third-party service firm, which deploys, manages and remotely hosts a pre-packaged software application through centrally located servers in a "rental" or lease arrangement. In exchange for accessing the application, the client renders rental-like payments. The following definition is offered by the ASP Industry Consortium:

"An ASP manages and delivers application capabilities to multiple entities from a data center across a wide area network." (Cherry Tree & Co., 2000).

The convergence of software and IT infrastructure toward an Internet/net-centric environment has enabled the ASP concept to emerge (see Figure 15). Software has evolved from custom-coded, proprietary applications to pre-packaged or off-the-shelf

applications and now to the development of net-centric applications. Net-centric software allows Web-enabled commerce, communication and the management of information content. Likewise, IT infrastructure has evolved from a closed, mainframe environment to distributed computing and now towards a net-centric infrastructure linking all stakeholders. The ASP concept also revisits the service bureau model that failed to materialize due to the availability of relatively inexpensive hardware, inefficient communication linkages and unattractive overall economics. There will need to be continual advances, particularly in software and broadband technologies to further propel growth in the ASP market (Cherry Tree & Co., 2000).

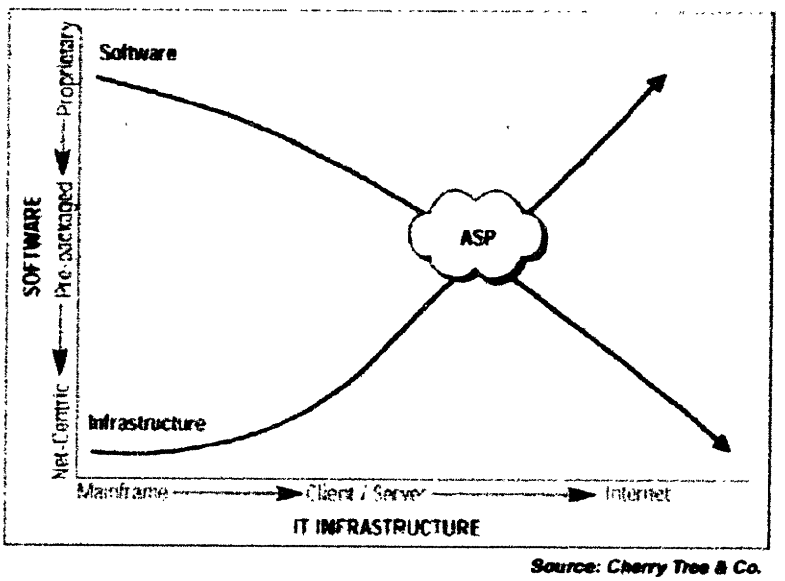

Figure 15. Convergence of Software & IT Infrastructure Enablers New Application Model
(Source: Cherry Tree & Co., 2000)

An ASP acts as an intermediary by facilitating a remote, centrally managed "rent-an-application" service between the organization or client and the independent software vendor (ISV) (see Figure 16). The emphasis is placed on the *use* not the *ownership* of the application. The end client no longer owns the application or the responsibilities associated with initial and ongoing maintenance. The client, either through an Internet browser or thin-client technology, accesses remote, centralized computer servers hosting the application. Only the results from the application are managed locally by the client.

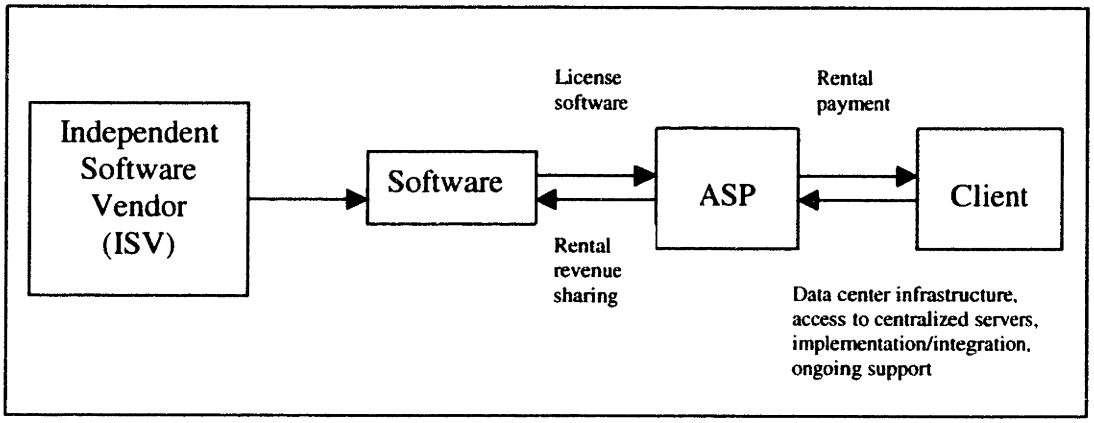

Figure 16. ASP Relationship (Source: Cherry Tree & Co., 2000)

There are many variations from the simplistic model presented in Figure 16. It is conceivable for the ISV to entirely bypass the ASP and interact directly with the client. It is also possible that there exists another entity or partner residing between the ASP and the end user. For instance, Concentric Networks and Exodus Communications manage the data center infrastructure for Corio, a "pure-play" ASP (Cherry Tree & Co., 2000).

ASP Characteristics

ASPs have typically negotiated short-term, non-exclusive licensing agreements with independent software vendors. An ASP can deliver any type of software application, from basic e-mail and messaging applications to a complete ERP system that manages, controls and reports on the multiple aspects of an enterprise. The ASP provides the pre-packaged application, infrastructure capabilities, the initial and ongoing support services and some degree of customization if requested. The level of customization being performed by ASPs is minimal by today's standards. In fact, several of the leading ASPs have publicly acknowledged the lack of high level customization. Early ASP market leaders have limited their implementations to core application functionality and, on several occasions, have publicly expressed a disinterest in building highly customized solutions (Cherry Tree & Co., 2000).

Pricing Models

The ASP receives a multi-year contract, normally ranging from 18 to 36 months. A typical client relationship includes a fixed monthly payment structure ordinarily based on the number of users. However, new technologies are permitting payment schemes based on variable terms such as the number of transactions, the number of screen clicks and amount of usage time.

Pricing of the ASP service is a composite of each of the channel responsibilities and their relative costs. At the present time, there is a high degree of uncertainty regarding pricing structures and precisely where the market will assign a price ceiling. Cost and profitability will vary based on the complexity of the hosted applications. Current estimates place gross margins in the 30% to 45% range once economies of scale can be recognized (Cherry Tree & Co., 2000).

During the development stage, ASPs will require significant investments to put in place the various resources necessary to manage the ASP relationship. Consequently, pricing and direct cost relation-ships will vary substantially during this period. Pricing and profitability should improve as economies of scale can be achieved by spreading sunk costs such as data center expenditures across each new client (Cherry Tree & Co., 2000).

Status of the ASP Market

With the birth of the industry in November 1998, the ASP industry is clearly in the embryonic stages of its life cycle despite all the hype and attention. Forrester Research estimates more aggressive growth for the application outsourcing (AO) with the market reaching $21 billion by 2001. According to IDC, the worldwide ASP market will soar from $295 million in 1999 to $7754 million in 2004, almost double annually, as illustrated in Figure 17 (www.IDC.com).

Figure 18 illustrates that only early adopters just step into the ASP market. The early adopters and targeted markets for the ASP alternative have been small to medium size enterprises (SMEs). Forrester Research estimates that there are 300,000 emerging

enterprises in the U.S. with revenues between $40 million to $500 million and IT budgets of $5 million or less. Based upon IDC's projections, less than 5% of the emerging enterprises in the U.S. will need to utilize an ASP solution to achieve this projected market size (Cherry Tree & Co., 2000).

The increasing of ASP market attracts more and more firms enter the market. Founded by 25 companies in May 1999, the ASP Industry Consortium hit 100 members in less than three months, doubled that figure by early November 1999. Currently, more than 700 members in 30 countries on five continents have joined the Consortium.

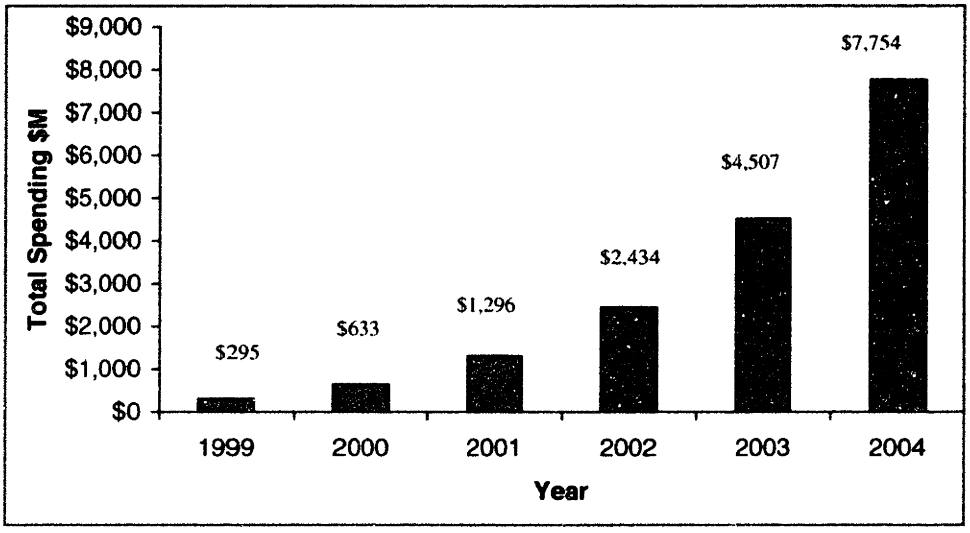

Figure 17. World ASP Market Growth (Source: IDC, 2000)

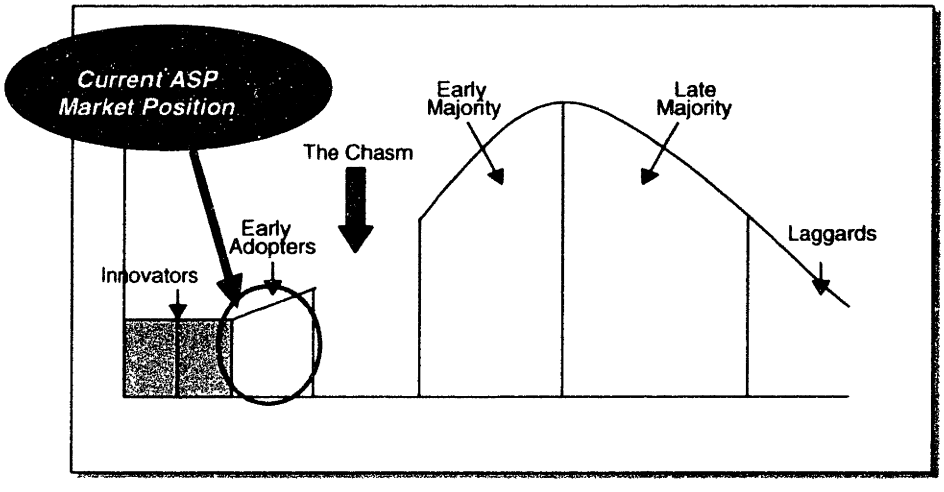

Figure 18. World ASP Market Position (Source: The Chasm Group, 1999)

Catalysts for the ASP Market

Figure 19 illustrates the enabling, technical and business drivers shaping the ASP market. Some of the key enabling technologies that are reinforcing the fundamental ASP market include the following:

- Ubiquity of the Internet: The migration from in-house application management to a hosted application solution has become feasible with the pervasiveness of the Internet and continuous development of Web-enabled solutions.
- Access and declining cost of bandwidth capacity: The combination of increasing accessibility and the continued declining cost of bandwidth enables a hosted solution delivered over the Internet or through thin-client computing to become a viable alternative.
- Shared applications in a client/server environment: The remote access of the ASP concept is not a radical departure from the application delivery that users have become accustomed to with client/server technologies.
- Browsers as an accepted GUI application: The acceptability of browsers as a functional graphical user interface (GUI) has increased with the growing popularity of Web-enabled and thin-client computing.
- Potential of e-commerce and e-business solutions: Comprehensive e-commerce and e-business solutions share many of the same business and technical concerns for security and reliability that presently threaten the ASP concept. The resolution of these issues in e-commerce and e-business will positively influence the perception of hosted applications (Cherry Tree & Co., 2000).

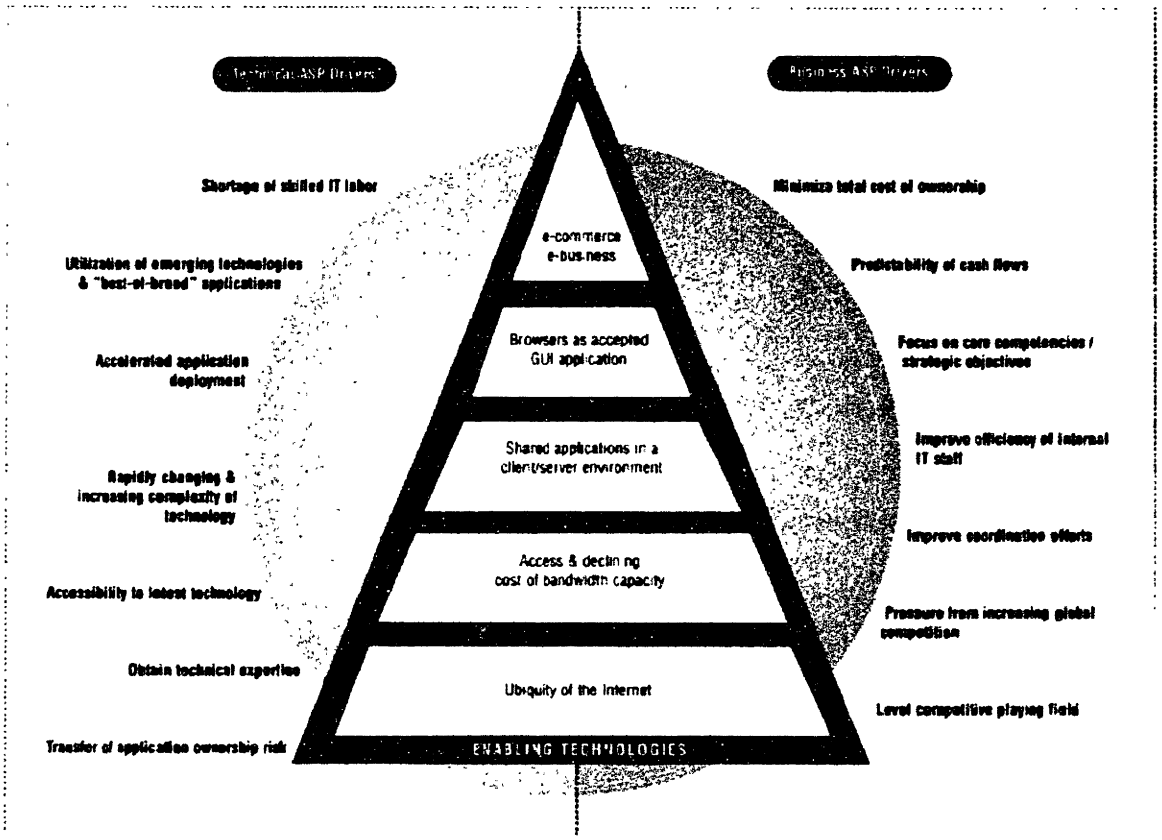

Figure 19. Enabling, Technical & Business Factors Driving the ASP Industry

(Source: Cherry Tree & Co., 2000)

The following technical drivers or factors also impact the viability of the ASP concept:

- Shortage of skilled IT labor: Organizations, particularly smaller entities such as online learning center, cannot afford the time and considerable expense associated with recruiting, training and retaining IT personnel.
- Utilization of emerging technologies and "best of breed" applications: The ASP, due to its favorable economics, allows smaller organizations to employ sophisticated applications such as supply chain management (SCM) and customer relationship management (CRM), which is particularly helpful for the independent e-publishers. Today these applications have only been affordable and manageable by larger enterprises.
- Accelerated application deployment: META Group research indicates the average duration for an ERP deployment continues to be over 12 months. Implementation periods become measured in days and weeks in the ASP model compared to months and years through traditional channels.

- Rapidly changing and increasing complexity of technology: Internal IT departments struggle with the rapid pace of IT development and its increasing complexity. The ASP concept resolves the internal uncertainty by assuming the application responsibilities and costs.
- Obtain technical expertise: Many ASPs currently focus on a particular vertical market, business function or application type. This focused approach becomes more valuable to an organization searching for a specific need.
- Transfer of application ownership risk: Internal IT departments have traditionally been very concerned about the viability and acceptance of an application among its users. These concerns have affected many organizations' willingness to deploy the next "killer app" (Cherry Tree & Co., 2000).

Some of the important business drivers or factors influencing the emergence of the ASP concept include:

- Minimize total cost of ownership: The ASP alternative typically translates into a 30% to 50% annual savings, varying by the complexity of each application.
- Predictability of cash flows: The ASP concept introduces a degree of predictability by eliminating the uncertainties of post-implementation software-related expenditures.
- Focus on core competencies and strategic objectives: The transfer of the implementation and management of an application to a third party enables the organization to focus on developing its core competencies.
- Improve efficiency of internal IT staff: The elimination of application management enables the internal IT staff the freedom to develop processes and systems to leverage core competencies.
- Improve coordination efforts on a global basis: The ASP concept can equip organizations with the latest technical tools and systems necessary to coordinate internal and external global operations (Cherry Tree & Co., 2000).

Issues or Barriers to ASP Concept

There are relevant issues and concerns challenging the diffusion of ASP. The challenges confronting the nascent ASP market are partly due to its relative infancy. However, these issues will need to be resolved or at least reasonably addressed before broad market acceptance materializes.

- Security of Information: One of the central challenges to the ASP concept is the uncertainty regarding the security of proprietary information. Organizations will generally be very apprehensive about jeopardizing sensitive information in complex hosting relationships. Undoubtedly, organizations will demand more stringent security standards from ASPs than would normally be imposed internally. The integrity and preservation of critical information will be an important benchmark for the success of the ASP concept.
- Overall Quality of Service & Support: Some of the performance concerns include issues of availability, scalability, bandwidth capacity, and data and network redundancy. Service level agreements (SLAs) are contractual agreements binding the ASP to a predetermined level of service and performance. These agreements obligate performance standards and measurements. A typical arrangement would require an ASP to provide 98.9% total service availability, which guarantees all but 40 minutes of downtime per week. The important point is that an ASP's quality of service will be evaluated by the ability to ensure no single point of failure, a capability to accommodate increasing network traffic spikes, and the perception that the system is locally based.
- Scope & Flexibility of Services: There is a tradeoff between scope and flexibility for ASPs. These demands require both front- and back-end expertise from an ASP, including general expertise in the application, a solid understanding of the implementation, and a knowledge base regarding infrastructure requirements. This challenge is further complicated by the notion that organizations will require an ASP to be flexible to meet their unique demands. The issue becomes whether the ASP or the application has the unique characteristics and flexibility to accommodate for all and changing demands.

- Adaptability of Software: Most software today is not truly web-enabled. To be most efficient, most existing ERP software applications need to evolve toward a true net-centric model that is capable of leveraging the Internet by greatly increasing accessibility, gathering information from multiple destinations and reducing maintenance demands. Future applications will need to be developed with modular components that can be upgraded for improved functionality.

Second Generation of ASP

Figure 20 illustrates the trend away from the basic ASP offering towards a series of potential value-added services or characteristics that result in higher customer switching costs and higher barriers to entry. The bottom line for the ASP is a more profitable and sustainable business model. Although it is very difficult to illustrate all of the feasible value added components, Figure 20 sets forth some of key differentiators that gain the most traction in the market today. Instead, companies that ultimately build sustainable ASP related businesses will offer a value-added component(s) to their service as competitive edge that is simultaneously difficult for competitors to replicate and customers to replace. Figure 21 illustrates the evolution towards 2nd Generation, higher value-added BSP, FSP, VSP. The first generation of ASP was in 1998 and 1999, while the second generation of ASP emerges from 2000 to 2003.

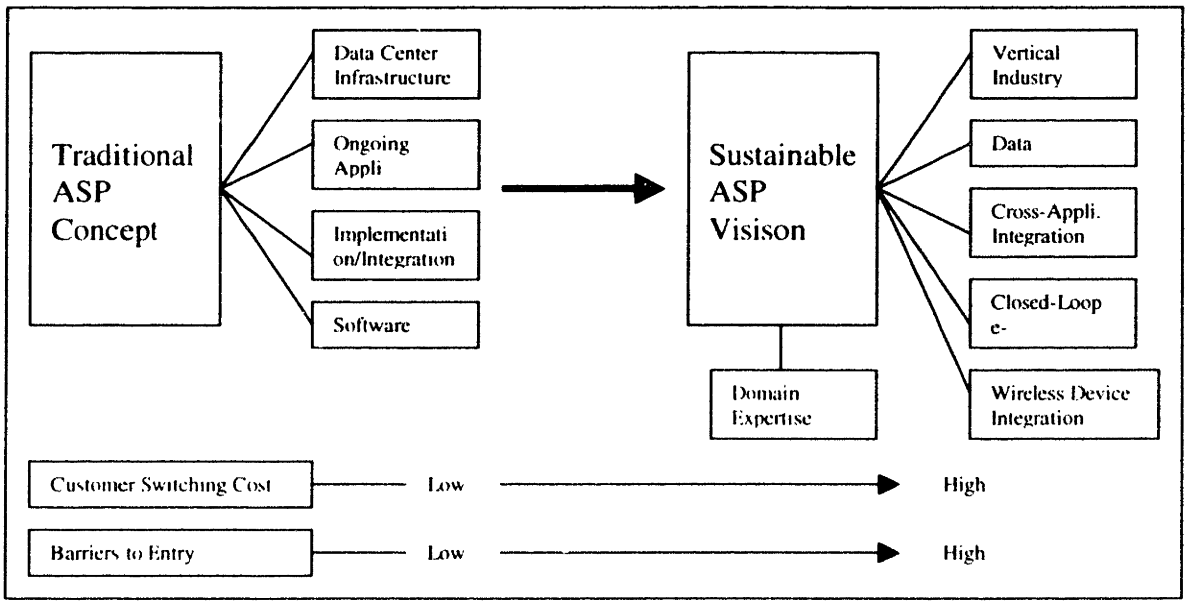

Figure 20. Evolution of ASP Value Proposition (Source: Cherry Tree & Co., 2000)

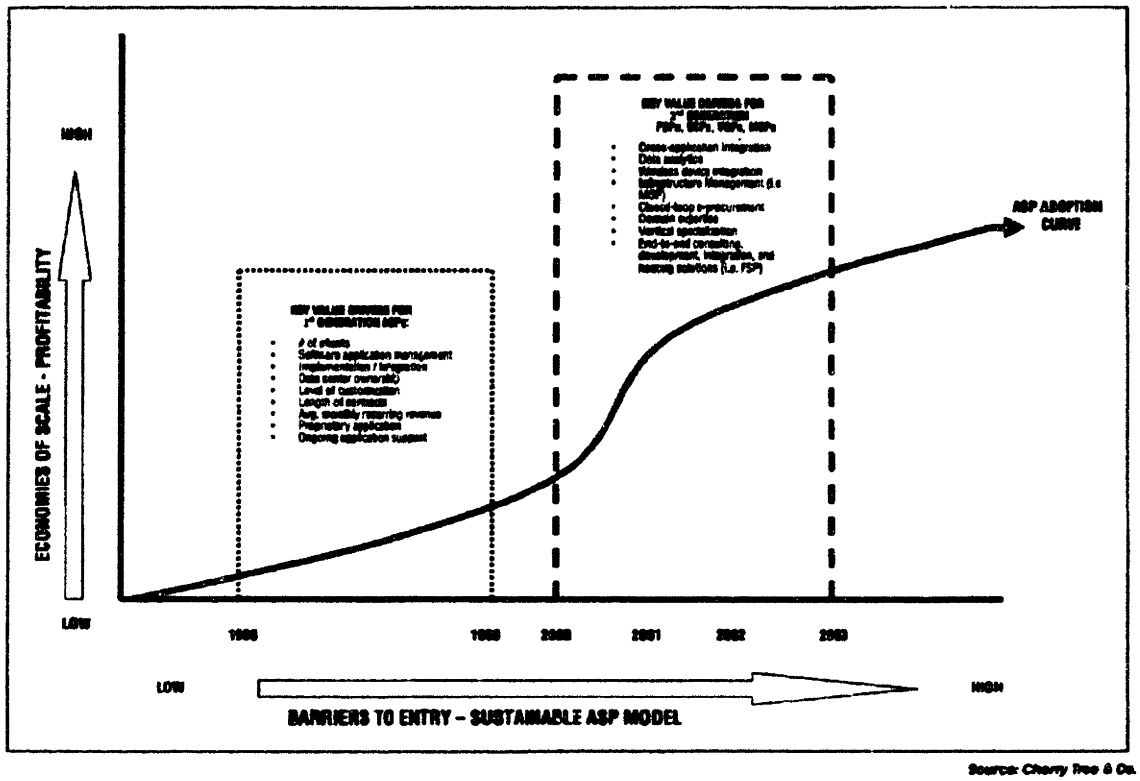

Figure 21. Evolution of 2nd Generation BSP, FSP, VSP Business Models

(Source: Cherry Tree & Co., 2000)

During the 2nd generation of ASP, there are various value creation strategies, as following:

1. **Domain Expertise Emphasis:** In contrast to "one-stop shop" ASPs offering a wide range of applications. A number of ASPs are focusing on developing deep expertise in delivering applications within a given functional area, such as human resources, facilities management, or procurement. The value added component that these companies typically bring to the table is three-fold:
    - They generally either own the software or have developed proprietary integration methodologies for the software and therefore benefit from their ability to develop functionality that is highly specialized for the particular domain they have selected;

- Their expertise within the domain creates substantial consulting services opportunities because the knowledge they bring to customers is highly valued; and
- Their knowledge within the domain is difficult for other companies to replicate thereby creating natural barriers to entry (Cherry Tree & Co., 2000).

2. **Vertical Industry Emphasis:** Vertically focused ASPs (sometimes called Vertical Service Providers, or VSPs) offering industry-specific applications are also emerging. The basic premise behind these firms is that each industry (financial services, healthcare, telecommunications, professional services, etc.) has its own unique set of characteristics that can best be served by companies that focus exclusively on the given industry. The value added component of the vertical specialist's offering generally falls along three lines:
   - VSPs have typically developed vertically-oriented, templated methodologies that they are able to easily deploy across multiple clients within the same industry;
   - They have generally cultivated a great deal of expertise with industry-specific business processes and functional requirements, enabling them, where appropriate, to rapidly build more tailored solutions on top of their templated solutions;
   - Their deep industry knowledge allows them to take on the most complex issues faced by organizations within a particular vertical, rather than providing more generic, easily replicable applications that are typically not flexible enough to serve the unique requirements of the given industry.

3. **Infrastructure Emphasis:** An emerging class of services firms has opted to approach the ASP market by providing infrastructure management and outsourcing services to ASPs, freeing up their resources to focus more directly on application management issues. These infrastructure players, which variously term themselves "Managed Service Providers" or "Infrastructure Management

Providers," provide an additional layer of network and data center management software between ASPs and their Web hosting partners. Key areas of infrastructure management functionality include:

- Network and application monitoring, testing, and maintenance;
- Database architecture and management;
- Systems and network management;
- Network and application performance assessment;
- Capacity scaling and load balancing; and
- Security (Cherry Tree & Co., 2000).

4. **Vertical Exchange Emphasis:** A number of companies that are hosting various types of e-procurement and supply-chain solutions are beginning to pose a basic threat to the vertical exchanges that have popped up in most industries. Examples of such vertical exchanges include Ventro, Neoforma, Chemconnect, e-Steel, and PlasticNet. The long-term strategy of many of these vertical exchanges obviously hinges on their ability to control the majority of the transactions within a specific industry. Once accomplished, they would likely be viewed as the *de facto* solutions provider for the industry. The value-added components of an ASP that is providing a B2B exchange typically include:
   - Deep knowledge of supply-chain participants within the given vertical industry;
   - Enable direct or "closed-loop" supplier/customer relationships that avoid the margin stacking sometimes associated with vertical portals;
   - Automatic replenishment of majority of supplies enabled by direct supplier/customer relationship;
   - Expertise with industry-specific business processes and functional requirements enable service providers, where appropriate, to build more tailored solutions on top of their templated solutions;
   - Typically offer solutions that go beyond mere e-procurement to include sophisticated inventory management and business intelligence functionality;

- Enable a common data platform that facilitates two-way flow of information between suppliers and customers;
- Reduce tremendous waste in the procurement process (Cherry Tree & Co., 2000).

5. **"Riding the Hot App" Emphasis:** This strategy is perhaps best explained by example. Minneapolis-based Interelate is a startup ASP focused solely on business intelligence and customer analytics applications. Interelate hosts and manages business intelligence applications that have been developed by E.Piphany and Net Perceptions. Interelate's offering includes sales forecasting, reporting, and analysis, customer behavior and profitability analysis, channel analysis, cross-sell and up-sell analysis, and campaign management. The company also provides pre-built data marts for financial services and e-commerce clients, and has signed such customers as McKinsey & Co., Goldman Sachs, Nissan, and Medtronic. E.Piphany and Net Perceptions both market "hot apps" directly to very large customers, but, like many other software companies, have found that their central core-competence is in R&D and software development - not in managing large sales forces that broadly proliferate product to companies of all sizes. Similar to the basic manufacturer/distributor relationship, the developers of these "hot applications" find that they need partners who have a core-competence in distributing the product. Interelate takes advantage of this reality by developing a deep, and proprietary, core competence in implementing and managing these applications on a hosted basis for customers that would not fall within the general purview of direct sales efforts of the software vendor. By mastering the intricacies of implementing, customizing, integrating, and hosting these applications - both at the application layer and at the net-work/systems layer - Interelate has carved out a niche for itself with customers who already have a strong interest in these applications. To summarize, the value added component of this ASP business model stems from:

- Deep knowledge and services capability that permits the ASP to tweak the applications to ensure that they deliver the highest potential value to end users;
- Deep knowledge of how to manage the systems layer in a manner which is specific for the chosen application and for a given customer to assure the highest level of application performance possible; and
- Ultimate access to the customer based on the consulting/ser-vices approach to growing the business (Cherry Tree & Co., 2000).

6. **Full Service Provider Emphasis:** An increasing number of IT services firms are forgoing pure application hosting in favor of providing an end-to-end solution encompassing IT consulting, application development, systems integration, and application hosting. Since consulting firms and project-based service providers often enjoy strategic, long-term relation-ships with their clients, they are often in an enhanced position to offer hosted solutions. The value proposition of the full service provider (FSP) model is two-fold:
   - For services firms that are building or integrating customized applications and e-commerce systems for their clients, their extensive knowledge of these applications makes them ideal hosting and maintenance partners. Adding an application hosting offering may be a natural extension of their core business, particularly for firms utilizing an offsite development model.
   - Firms in this space are also more likely to be familiar with architecting Internet-based applications (as opposed to Internet-enabled client/server systems with GUI front ends), translating into superior system performance in the context of an ASP delivery model (Cherry Tree & Co., 2000).

7. **Security Infrastructure Emphasis:** A recent study conduct-ed by the US Defense Information Systems Agency revealed a 65 percent success rate for attempted security breaches, with 96 percent of these breaches going undetected. As enterprises move a larger proportion of their operations online, these types of

security issues are becoming increasingly critical to Old and New Economy firms alike. As a result, security is now being viewed less as a one-time firewall installation than as a continuously evolving utility service. Some of the basic value propositions of the hosted security provider include:

- 24/7 monitoring of security services to ensure detection of unwanted entry into systems;
- Continual management and updating of critical security initiatives including PKI infrastructures and certificate authorities, which often require human intervention despite the sophistication of the underlying e-security technology;
- Continual updates of underlying e-security systems that evolve with the requirements of the enterprise;
- Enterprise network perimeter security (inbound and outbound network traffic filtering);
- Secure Web site and e-commerce application hosting services,
- Intra-enterprise WAN connectivity,
- Extranet and virtual private network (VPN) connections to supply chain partners, and
- Remote access and secure e-mail communication (Cherry Tree & Co., 2000).

8. **Aggregator Emphasis:** The ASP aggregator model is based on the premise that the rapid proliferation of firms offering ASP services has created an overly complex market for medium-sized enterprises to deal with when investigating application outsourcing options. In addition to the difficulties involved in evaluating potential service providers, enterprises that require several best-of-breed solutions are faced with the complexities of managing relationships with multiple ASP partners. The value added component provided by ASP aggregators is premised on their serving as a single point of contact for the customer, with the following benefits:

- Aggregators consolidate the services offered by multiple ASPs into a single menu of best-of-breed applications, allowing clients to sample, order, and utilize disparate ASP offerings while avoiding the need to manage multiple hosting contracts and systems;
- They also provide improved flexibility, consolidated billing, fully integrated applications, and a single contact for technical support issues (Cherry Tree & Co., 2000).

Section 2.5 e-Knowledge Commerce Business Models

From the discussion above, it can be seen that the business models of e-knowledge commerce are quite different as conventional e-commerce, which is discussed in details as following:

B – B: Companies can trade not only parts, but also their Intellectual Property such as training courses, patents, etc. online. The reason for the companies to share the training courses is that generally the cost is $300,000 to create one training course and $50.000 to translate into another language if necessary. These are heavier burdens for the multiple-national corporations, who have dozens of thousands of employees around the world need to be trained annually. Another main type of B to B E-Knowledge Commerce is patent licensing. For example, the royalty of patent licensing for IBM reached $1.5 billion in 1999. Patent licensing is changing from a trivial to a main resource of profit for companies, universities and federal labs.

B - P: Such as software selling or renting from business to individual persons.

P - B: This kind of model does not exist in conventional E-Commerce, but only in E-Knowledge Commerce. This is due to the unique characteristics of knowledge products. It is very difficult for individual person to create and copy the physical products by large volume, which prevents the existing of large volume C-B model in E-Commerce. But, knowledge products can be copied in large volume at almost zero cost, and easy to be distributed to companies around the world. The independent consultants, instructors, patent/copyright owners can be the knowledge-providers in the P–B model. For example,

individual person can sell many copies of software to companies, or license patent to various firms around the world. Also in click2learn.com, individual can design and teach courses to any quantity of employees of firms around the world.

P – P: This P-P model is also different from the C–C model in E-Commerce. In E-Commerce, individual can sell some PCs to a small amount of persons. But, for E-Knowledge Commerce, individual person can sell knowledge products to any number of persons at any volume, e.g., e-learning. The author can establish his own WebPages and sell his courses or books to millions of persons.

Comparisons of Business Models

Table 4 and 5 illustrates the business models of conventional and E-Knowledge Commerce respectively. Since e-knowledge commerce overcome the barriers of distance and time, the existing knowledge market (e.g., education) is enlarged drastically and new market (e.g., personal digital library) is created.

Table 4. Conventional Knowledge Commerce Functions and Business Model

	Learning	Publishing	Library	Software	Conferencing	Consulting	Patent Licensing
B - B	**Yes**	**Yes**	**Yes**	**Yes**	**Yes (Travel)**	**Yes (Travel)**	**Yes (Travel)**
B - P	**Yes**	**Yes**	**Yes**	**Yes**	**Yes (Travel)**	**Yes (Travel)**	**Yes (Travel)**
P - B	**Yes**	**No**	**No**	**No**	**Yes (Travel)**	**Yes (Travel)**	**Yes (Travel)**
P - P	**Yes**	**No**	**No**	**Yes**	**Yes (Travel)**	**Yes (Travel)**	**Yes (Travel)**

Table 5. E-Knowledge Commerce Functions and Business Model

	e-Learning	e-Publishing	Digital Library	e-Software	e-Conferencing	e-Consulting	e-Patent Licensing
B-B	**Yes**	**Yes**	**Yes**	**Yes**	**Yes (Virtual)**	**Yes (Virtual)**	**Yes (Virtual)**
B-P	**Yes**	**Yes**	**Yes**	**Yes**	**Yes (Virtual)**	**Yes (Virtual)**	**Yes (Virtual)**
P-B	**Yes**	**Yes**	**Yes** (Personal DL)	**Yes**	**Yes (Virtual)**	**Yes (Virtual)**	**Yes (Virtual)**
P-P	**Yes**	**Yes**	**Yes** (Personal DL)	**Yes**	**Yes (Virtual)**	**Yes (Virtual)**	**Yes (Virtual)**

As discussed above, e-knowledge commerce includes e-Learning, e-Publishing, Digital Library, e-Software, e-Conferencing, e-Consulting, e-Patent Licensing, e-Knowledge Auction, e-Knowledge Stores or Malls, Stock Market or Investment Knowledge Exchanges, Community Oriented or Social Capital Oriented e-Knowledge Markets, Human Capital Exchanges, etc. However, "what makes *e-knowledge marketplaces* unique, is the commodity traded in them -various forms of knowledge."

Zero Cost to Duplication and Transaction

"*Knowledge* is a peculiar commodity. Previous economies that have been based on land, labor, and capital have had the constraint, that once these types of items are exchanged, they are either physically transferred, spent or alienated from the owner." (Davis, 2000, http://www.kikm.org/).

However, what sets knowledge apart, is the fact that knowledge can be copied readily. This unique characteristic will enlarge the knowledge market significantly. Why? If some has a land and don't want to loose it, so he will not put the land in the market. However, if he has some knowledge, he can sell it and yet still posses it & use it, which will encourage the knowledge owners to put more knowledge in the knowledge market.

Furthermore, according to economics and economy history in thousands of years, the reduction of transaction cost will enlarge the market. Knowledge can be duplicated to any large volume at the cost of almost zero and knowledge can be delivered in the digital form at the speed of light as fast as 300,000 kilometers per second at the cost of almost zero in the Internet. There is no transportation cost such as tangible stuff delivered in trucks or airplanes. This will enlarge the e-knowledge market drastically by creating a new business model P to B which only exists in e-knowledge commerce, not in conventional e-commerce. Independent consultants, instructors, patent/copyright owners can be the knowledge-providers in the P–B model. For example, individual person can sell many copies of software to companies, or license patent to various firms around the world. Also, individual can design and teach courses to any quantity of employees of firms around the world.

Network Effects and Increasing Return

Moreover, there are economic network effects and increasing return, especially accruing to first movers in virgin markets, where the more knowledge is exchanged, the more its value can grow. This is totally different from the conventional economy.

Conventional economic theory is built on the assumption of diminishing returns. Economic actions eventually engender a negative feedback that leads to a predictable equilibrium for prices and market shares. Negative feedback tends to stabilize the economy because any major changes will be offset by the very reactions they generate. For instance, water power and coal competed to drive electrical generators in the history. The two end up sharing the market in a predictable proportion that best exploits the potentials of each, in contrast to what happens for video recorders.

Increasing-returns economics has roots in economic thinking that go back for seventy or more years, but its application to the economy as a whole is largely new. The reasons that they have been largely ignored until recently could be:

- Some would say that knowledge-based products—high technology—for which increasing returns are so prevalent, are themselves a recent phenomenon. This is only part of the answer. After all, in the 1940's and 1950's economists identified "cumulative causation" or positive feedback mechanisms that did not involve technology.
- Some economists found the existence of more than one solution to the same problem distasteful—unscientific. "Multiple equilibria," wrote Josef Schumpeter in 1954, "are not necessarily useless, but from the standpoint of any exact science the existence of a uniquely determined equilibrium is, of course, of the utmost importance.
- Other economists could see that increasing returns would destroy their familiar world of unique, predictable equilibria and along with this the notion that the market's choice was always best (Quinzi, 1992).

While diminishing returns imply a single equilibrium point for the economy, positive feedback—increasing returns—make for multiple equilibrium points. The situations dominated by increasing returns should be modeled as dynamic processes with random events, and with natural positive feedbacks or non-linearities, rather than static, deterministic problems. It would be impossible to know in advance which of the multiple solutions would emerge in any given run, but it would be possible to record the particular set of random events leading to each solution and to study the probability that a particular solution will emerge under a certain set of initial conditions. The idea was simple and it may well have occurred to economists in the past. But making it work called for non-linear random-process theory that did not exist in their day.

Conventional economics continued to work well in the resource-based economy such as agriculture, bulk-goods production, and mining, which are still subject to diminishing returns. On the other hand, the exploding knowledge-based economy is largely subject to increasing returns. Due to learning by doing, the production cost decreases when production increases. Furthermore, the benefits of using them increase, as the network effect. Increasing return will lead for one technology to lock in, and the locked-in technology will eventually be replaced when a new generation of advances arrives.

The rising importance of increasing return brings significances such as:

- Steering an economy with positive feedbacks so that is chooses the best of its many possible equilibrium states requires good fortune and good timing.
- Countries that gain high volume and experience in a high-technology industry can reap advantages of lower cost and higher quality that may make it possible for them to shut other countries out. Knowledge gap and digital gap between developed countries and developing countries are interconnected and reinforce each other. e-knowledge commerce will also follow increasing return, grow rapidly in developed countries and ignore developing countries.
- Industry and trade policy under increasing returns are currently being studied intensely. The policies countries choose will determine not only the shape of the global economy in the 1990's, but also its winners and its losers.

- Increasing returns mechanisms can also cause economies—even successful ones such as the US and Japan—to become locked into inferior technology-development paths. A technology that improves slowly at first but has enormous long-term potential could easily be shut out, thus locking an economy into a path that is both inferior and difficult to escape (Arthur, 1997).

Unlike natural resources will be exhausted by consuming, new knowledge can be created when using existing knowledge. This means knowledge is endless and the cycles of increasing return of knowledge will also be endless. One technology will lock in by increasing return, and the locked-in technology will eventually be replaced when a new generation of advances arrives.

"You cannot deplete a knowledge resource the same way you could a pool of oil. We have also an infinite capacity to use our imaginations to invent, to come up with new formulations. This is *the special power of knowledge*. Knowledge as a wealth creating resource, is distinctive in that wealth can be created from merely a great idea. That's why Walter Wriston, former chairman of Citibank, a Banker, could observe that *intellectual capital* was becoming more valuable than mere capital. Knowledge is indeed a new form of currency. So, it's not surprising that we should be now inventing new specialized virtual online e-knowledge marketplaces, in which to globally trade and exchange ideas, brain-power, expertise, talent, professional services, know-how, intellectual property, learning, knowledge products and all forms of intellectual capital." (Davis, 2000).

Due to the uniqueness of e-knowledge commerce, it is projected to be the next and much larger wave than e-commerce. According to the Kaieteur Institute For Knowledge Management, 2000, the global e-Knowledge Market will grow to be a $1 trillion global micro-economy by 2010. The exploding global e-Knowledge Market creates great opportunities for the Global Knowledge Network, which is the convergence of Knowledge-based Economy, the Internet and the trend of Globalization. Combining with wireless Internet and mobile-commerce, Global Knowledge Network can provide such

services: 4A - anytime, anywhere, anybody and anyknowledge, which will be discussed in details in Chapter 3.

Chapter 3 Implication of Global Knowledge Network

Section 3.1 Case Study: Global System for Sustainable Development

As discussed in Chapter 1, there are three main trends that shape the new global economy, creating both challenges and opportunities for enterprises. First, the spread of the Internet drags every firm into the digital world; second, knowledge is becoming more and more important for the survival and development of the companies; third, under the pressure to protect the environment, the emergence of 'environment' and 'sustainability' as new factors in corporate strategy.

In this context, the Global System for Sustainable Development -- global knowledge network designed and developed to catch – and to some extent, shape -- the emerging knowledge market surrounding issues related to sustainable development. GSSD is "an adaptive and evolving global knowledge system dedicated to sustainable development based on distributed networking principles and practices." (Choucri, 1999).

The evolving GSSD knowledge base currently consists of multidiscplinary content from over 2500 cross-referenced, indexed and abstracted www sites drawn from over 250 institutions, which manage their own databases, information, and knowledge – and what they choose to make public. The system's knowledge content is organized by subject (slices), by dimension of sustainability (rings), and by type and form of data or knowledge – at various levels of social aggregation and analysis. A set of dedicated search and browser functionalities – operating over the knowledge base – enables users to identify and retrieve knowledge of relevance to them and, as needed, to steer to the original site. In addition, a set of multi-lingual functions enable users to operate in, and provide knowledge from, different cultural and linguistic contexts on a world-wide basis.

GSSD was selected as one of the best professional Web sites by Internet Scout report 1999 as the first large scale, distributed, meta-knowledge networking system dedicated to the multidimensionality of sustainability. The Internet Scout Project is an NSF-sponsored organization based in the Department of Computer Sciences at the University

of Wisconsin-Madison. Details on definitions, design and the theoretical framework of GSSD can be found at: http://gssd.mit.edu/

To date, GSSD has served as a generic knowledge platform on sustainability, structured around subjects and issues, dimensions and features, and without restriction to any particular agent, actor, or institution. Its value-added is thus tied to its architecture and applications to the domain of sustainable development. Currently, however, GSSD is in a new developmental phase . First is customizing the platform to a desegregation of industry and manufacturing activities; and second is customizing to a particular global enterprise. In each case, the platform remains generic, but the contents are context, industry, or enterprise specific. In terms of new functions or 'services' the system's development is moving in to several directions, including partitioning of access.

Partitioning segments user access by range and scope. For example, in terms of:

a. Visitor Open Area: Including the site segments of Introduction, GSSD news, public information such as government report, examples of the various functions: online publishing, conferencing, training courses, digital library, consulting, etc.
b. Member Special Area: Targeted to individual user-institutions, for example, whereby each member (individual, university, company, government agency, etc.) has a member ID, account and password, for the purpose of security, charge (search in GSSD database or download papers) and payment (put their papers/case studies into GSSD). Member Special Area includes access to GSSD database, and then also utilize the various functions: online learning, online publishing & digital library, video conferencing, etc. , over a restricted knowledge base.

Before developing the next generation of GSSD, it is very helpful to conduct a survey to find out what the users want from GSSD? How can GSSD attract more users and serve them better? Since GSSD is a combination of many characteristics, conjoint analysis could be very helpful to design the questionnaire and analyze the results.

Conjoint Analysis

There is one kind of typical problem that companies and marketing managers usually encountered in marketing research, namely when two issues (or problems) have to be addressed (solved): first, is to identify the characteristics of products consists of multi-attributes; second, is to enable consumers to use tradeoff to make an overall judgment about the relative value of those various characteristics for decision making (Green and Wind 1975). This duality is addressed by conjoint analysis, a measurement technique developed early 1970s developed by researchers from the fields of mathematical psychology and psychometrics.

Given the multi-attribute nature of the product, conjoint analysis becomes particularly useful in helping marketers to determine the consumers' 'part-worth' utilities for different attributes and their levels. With the understanding of such part-worth utilities, marketers can decide (a) what should be the basic features of the product offerings and (b) at what levels these attributes should be balanced/combined. The estimated part-worth could also be helpful to segment the market (Jain, et al, 1982, McFadden, 1976, Srinivasan and Allan, 1973, Wind and Jain, 1972,).

Since the 1975, conjoint analysis has attracted considerable attention as a method that portrays consumers' decisions realistically as trade-offs among multi-attribute products or services. Conjoint analysis gained widespread acceptance and use in many industries, with usage rates increasing up to tenfold in 1980s. During the 1990s, the application of conjoint analysis increased even further, spreading to many fields of study. The widespread utilization of conjoint analysis for marketing consumer products as well as for a product development led to its adoption in many other areas, notably industrial marketing. This increase in usage in the United States has been paralleled in other parts of the world as well, particularly in Europe.

The development of computer programs accelerated the use of conjoint analysis, integrating the entire process, generating the combinations of independent variable values to be evaluated, and creating choice simulators for predicting consumer choices across a

wide number of alternative product and service formulations. Today, several widely employed packages are available to any researchers through personal computers.

Conjoint analysis is also closely related to experimentation design. For example, Ford engineers have to identify which factors influence the variance of the time to open the power window, the time to start the engine in Winter, or the uniform thickness of coating on the new car "focus". The engineers used the software "Design Expert" to conduct experiments and analyzed with ANOVA (analysis of variance) procedures. In situations involving human behavior, it is also necessary to conduct "experiments" with the factors that the experiment-conductor can control. For example, should the color be red or green? Which of three prices should be charged? The conjoint analysis technique developed from the need to analyze the effects of the factors the experiment-conductor control (independent variables), which are often qualitatively specified or weakly measured. Conjoint analysis is actually a family of techniques and methods, all theoretically based on the models of information integration and functional measurement. By using both conjoint analysis and experiment design, Ford engineers successfully identified these factors and selected the suitable combination characteristics for "focus," resulting into one of the best-selling cars in Europe (Jones, 1999).

The challenge for the future development of GSSD is to understand the user-needs when users are commercial, for-profit, enterprises. Such needs and uses different fundamentally from those for government or for academic and research institutions. The following section of the thesis discusses the design and results of a questionnaire targeted specifically to obtain an empirical 'base-line' of user-needs.

Design of Questionnaire

From the experience of GSSD to date, it can be seen that the 'customers' can be divided into the two group noted above: researchers from universities and government agencies searching the references for their work and online publishing their papers, and mangers and product designers from industries looking for the knowledge they need and inputting their case studies into GSSD.

The questionnaire was divided into three main sections, namely, background, knowledge about sustainable development, GSSD functions. Background included the name, title and organization of the participants, plus their address, telephone number, email and WebPages. The second section asked the attendants' opinions about sustainable development, with questions such as "Does your institution & company think sustainable development is important?" "At what level of knowledge do you commonly need on sustainable development?" "When do you need knowledge about sustainable development? Where will you try to get it from?" The third section focused on the functions of GSSD. For example, questions were "What is your primary use of GSSD information?" "The information you find in the GSSD is sufficient or not?" "Which function of GSSD do you prefer?" "If you were to be charged to use GSSD, you'd like to pay according to visiting time or amount of information you download?" "If you were to submit information, papers, or other materials to GSSD, you want to be paid according to the amount or the quality of information you put into GSSD?" In all questions, 1 is the worst. After the results were received and complied, all the utilities were converted into the scale of 10.

In other words, questions 1 to 12 asked participants about their purpose to use GSSD and each function/characteristic of GSSD. The final question was to check the different weight across function/characteristics of GSSD, which was the core of Conjoint Analysis. Since in the characteristics of GSSD, it's already decided to develop all of the five functions (Online Publishing, Training Courses, Digital Library, Consulting, Conferencing) in GSSD, therefore, the following question focused on the different weight of the content of GSSD and annual fee.

As illustrated in Table 6, there were 3 options in Content sufficiency (adequate, partial, insufficient), 3 options in Content timeliness (timely, well-known, obsolete), 3 options about search (easy, intermediate, difficult), 2 options in annual fees for users (set somewhat arbitrarily at $200 or $500 for university or company), and 2 options for payment for submission of information, according to the quantity or quality of information. Totally there would be 108 alternatives, which were impossible for

participants to rank. To solve this problem, the special experiment design, 'orthogonal array', was used, so that the independent contributions of all five factors were balanced. In this way, each factor's weight was kept separate and was not confused with those of the other factors. Thus, as demonstrated in Table 6, there were 18 options for users or 'customers' to rank.

Table 6 Rank of the GSSD Options

GSSD	GSSD Characteristics/Services					
Options	Content	Content	Search	Pay According to	Annual Fee	Rank
A	Adequate	Timeliness	Intermediate	Quality	$200	
B	Adequate	Well Known	Difficult	Amount	$500	
C	Adequate	Obsolete	Easy	Quality	$200	
D	Partial	Timeliness	Difficult	Amount	$500	
E	Partial	Well Known	Intermediate	Quality	$200	
F	Partial	Obsolete	Easy	Amount	$500	
G	Insufficient	Timeliness	Difficult	Quality	$200	
H	Insufficient	Well Known	Intermediate	Amount	$500	
I	Insufficient	Obsolete	Easy	Quality	$500	
J	Adequate	Timeliness	Easy	Amount	$200	
K	Adequate	Well Known	Intermediate	Quality	$500	
L	Adequate	Obsolete	Difficult	Amount	$200	
M	Partial	Timeliness	Easy	Quality	$500	
N	Partial	Well Known	Difficult	Amount	$200	
O	Partial	Obsolete	Intermediate	Quality	$200	
P	Insufficient	Timeliness	Intermediate	Amount	$500	
Q	Insufficient	Well Known	Easy	Quality	$200	
R	Insufficient	Obsolete	Difficult	Amount	$500	

Result Analysis

There are two main methods to distribute the questionnaires: directly to the participants in the international workshop held by GSSD in January 2000, and to other users by emails with the target population of about 100. Totally we received 31 returns, including 12 from academic researchers and 19 from industries. The results came from the large organizations about sustainable development such as the Division of Sustainable Development in the United Nation, World Business Council for Sustainable Development, etc. Also, large industry giants from various industries such as ITT, Xerox, Dutch Telecom, IBM, AT&T, etc., took part in the survey. Totally, these 31 institutions & companies represented more than 170,000 employees. The participants

covered the main continents, France and German in Europe, Mexico and Argentina in South America, China, India, Egypt and Japan from Asia, Kenya from Africa, plus the United States and Canada in North America. The distribution of the participants around the world reflected the global strategy of GSSD. Following are the result analysis, in which the utilities of the options in question 3 – 12 are calculated and converted into the scale of 10.

For Question 2 "Does your company design products to be recyclable? ", 58% companies said: "Most of our products are recyclable", and Xerox said: "All of our products are recyclable." For example, if one Xerox copier is worn out, Xerox will take it back totally and dissemble the machine, then reuse the framework, etc.

For Question 3 "At what level of knowledge do you commonly need on sustainable development?", the participants were asked to rank 9 options. The average score of the options are calculated in Table 7 as following. In the table, the scores of Structured data and Expert Opinion are 7.2 and 7.0 respectively, which mean that these two kinds of knowledge are the top two concerns of customers. Also customers prefer Case studies and Description of models.

Table 7 Average Score of the Levels of Knowledge Customers Commonly Need on Sustainability Development (in scale of 10)

Structured data	Expert opinion	Case studies	Models	Verification of theories	Raw observations	Exposition of theories	Data	Simulations
7.2	7.0	6.4	6.2	5.4	5.3	4.6	4.6	4.0

Question 4 "When you need knowledge about sustainable development, you will try to get it from?" Table 8 demonstrates the average score of the sources of sustainable development knowledge. Asking experts is the first option for most of the participants, next is search online, which means a large potential market for GSSD. Journals, books and online learning are very close.

Table 8 Average Score of the Sources of Sustainable Development Knowledge

Ask experts	Searching online	Journals	Database	Books	Conference	Classroom Learning
6.1	5.4	5.2	5.1	4.8	4.8	2.3

(in scale of 10)

For Question 5 "Did you use any knowledge database about sustainable development before?", about 40% of the participants said "yes", and about 15% knew GSSD before (in Question 6). One of the reasons is that GSSD is only well known in academic, not yet in industry. GSSD has to provide more knowledge especially suitable for industry.

Question 7 asked the purposes of why customers use GSSD, whose results are illustrated in Table 9. Scientific information is the most preference, next is policy information.

Table 9 Average Score of the Primary Use of GSSD Information (in scale of 10)

Scientific information	Policy information	Finding people	Reference	Overview	Publishing	Connections
6.2	5.7	4.8	4.6	4.6	4.3	4.1

From the answer of Question 8, about half of the users found the information in GSSD is adequate and timely, and GSSD is easy to search. Table 10 demonstrates the average score of GSSD new functions. The score of Digital Library is 6.2, the favorite function of GSSD customers. GSSD users prefer Online Publishing and Training Courses too, while they don't care too much about Conferencing and Consulting.

Table 10 Average Score of GSSD New Functions (in scale of 10)

Digital Library	e-Publishing	Training Courses	Conferencing	Consulting
6.2	5.0	4.6	3.4	2.8

For Question 10, "If you were to be charged to use GSSD, you'd like to pay according to", about 40% of customers said they'd like to pay by visiting time, others selected "The amount of information you download".

If there will be annual fee for GSSD members, almost everyone said $50 for researcher is fine, but $500 is too high for institution, some participants said $200 is acceptable.

To compare the weight of various factors, the next step is to extract information from the ranks of the 18 options by calculating the utilities of each factor. First calculate the average rank of each option from all feedback, then use the average rank to calculate the utilities of each factors. Table 11 illustrates the average scores of the options, sorted according to the score.

Table 11 Average Ranks for the Options

Average	GSSD	GSSD Characteristics/Services				
Rank	Options	Content	Content	Ease of	Payment Criteria	Auual Fee
		Sufficiency	Timeliness	Use		Univ./com
18.0	J	Adequate	New	Easy	Amount	$200
16.9	C	Adequate	Obsolete	Easy	Quality	$200
15.7	A	Adequate	New	Intermediate	Quality	$200
15.1	K	Adequate	Well Known	Intermediate	Quality	$500
14.2	B	Adequate	Well Known	Difficult	Amount	$500
13.5	M	Patial	New	Easy	Quality	$500
11.9	F	Patial	Obsolete	Easy	Amount	$500
11.3	E	Patial	Well Known	Intermediate	Quality	$200
9.7	L	Adequate	Obsolete	Difficult	Amount	$200
8.8	D	Patial	New	Difficult	Amount	$500
7.9	O	Patial	Obsolete	Intermediate	Quality	$200
7.1	N	Patial	Well Known	Difficult	Amount	$200
6.3	Q	Insufficient	Well Known	Easy	Quality	$200
4.9	P	Insufficient	New	Intermediate	Amount	$500
4.5	H	Insufficient	Well Known	Intermediate	Amount	$500
4.0	I	Insufficient	Obsolete	Easy	Quality	$500
2.0	G	Insufficient	New	Difficult	Quality	$200
1.0	R	Insufficient	Obsolete	Difficult	Amount	$500

Utility of Content adequate: (18+16.9+15.7+15.1+14.2+9.7)/6 = 14.9

Utility of Content partial: (13.5+11.9+11.3+8.8+7.9+7.1)/6 = 10.1

Utility of Content insufficient: (6.3+4.9+4.5+4.0+2.0+1)/6 = 3.8

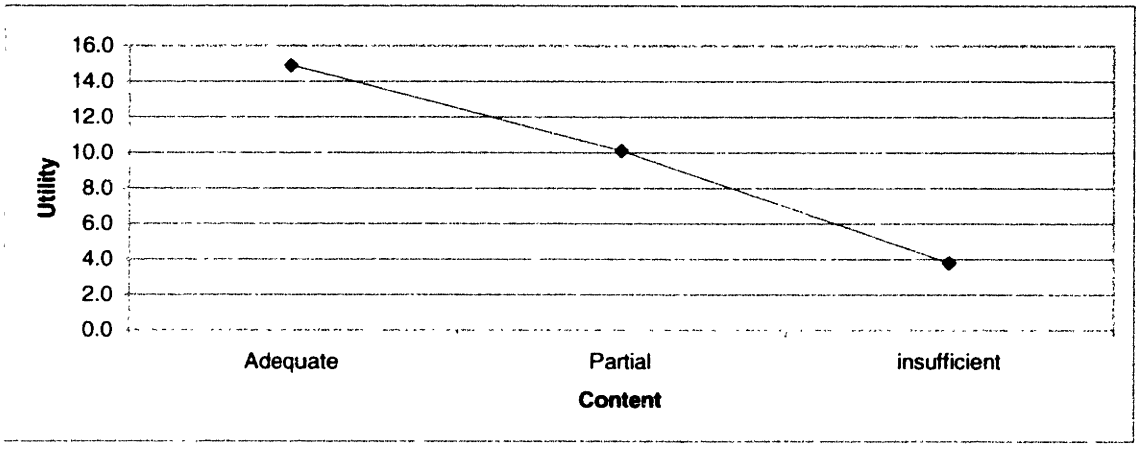

Figure 22. Utility of Content Adequate - Insufficient

Utility of Content new: (18+15.7+13.5+8.8+4.9+2.0)/6 = 10.5

Utility of Content well known: (15.1+14.2+11.3+7.1+6.3+4.5)/6 = 9.8

Utility of Content obsolete: (16.9+11.9+9.7+7.9+4.0+1)/6 = 8.6

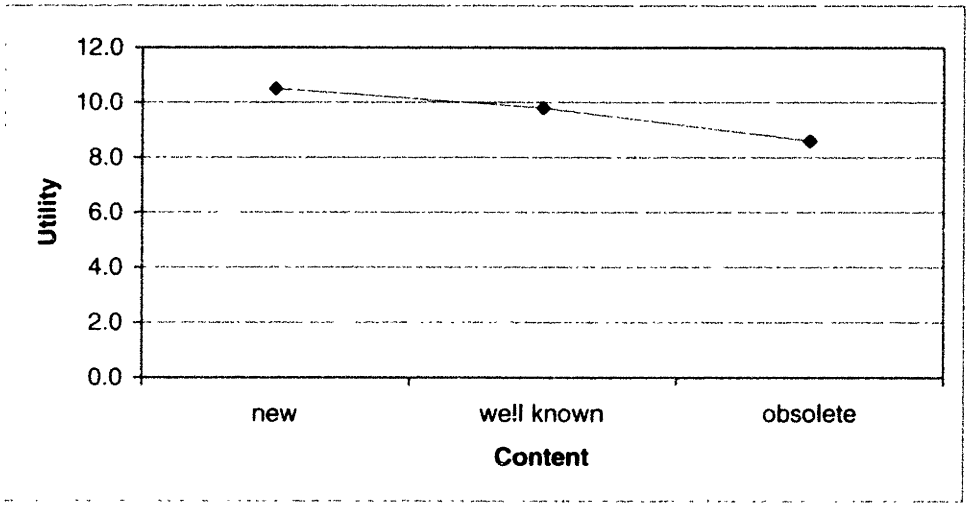

Figure 23. Utility of Content Timeliness

Utility of easy to search: (18+16.9+13.5+11.9+6.3+4.0)/6 = 11.7

Utility of intermediate to search: (15.7+15.1+11.3+7.9+4.9+4.5)/6 = 9.9

Utility of difficult to search: (14.2+9.7+8.8+7.1+2+1)/6 = 7.1

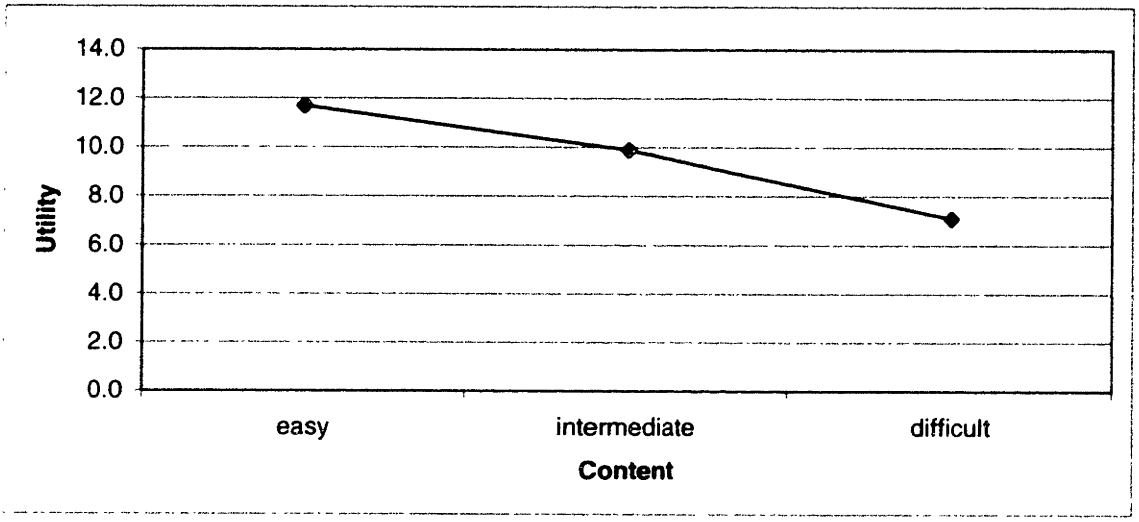

Figure 24. Utility of Easy -Difficult to Search

Utility of pay according to quality of information customers hand in:

(16.9+15.7+15.1+13.5+11.3+7.9+6.3+4+2)/9 = 10.3

Utility of pay according to amount of information customers hand in:

(18+14.2+11.9+9.7+8.8+7.1+4.9+4.5+1)/9 = 8.9

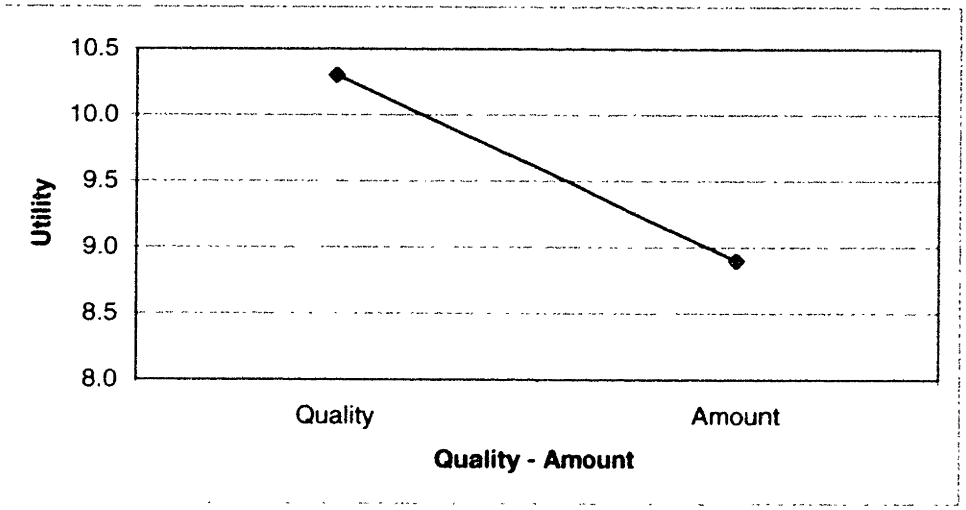

Figure 25. Utility of Payment Criteria

Utility of annual fee as $500: (15.1+14.2+13.5+11.9+8.8+4.9+4.5+4.0+1)/9 = 8.7

Utility of annual fee as $200: (18+16.9+15.7+11.3+9.7+7.9+7.1+6.3+2)/9 = 10.5

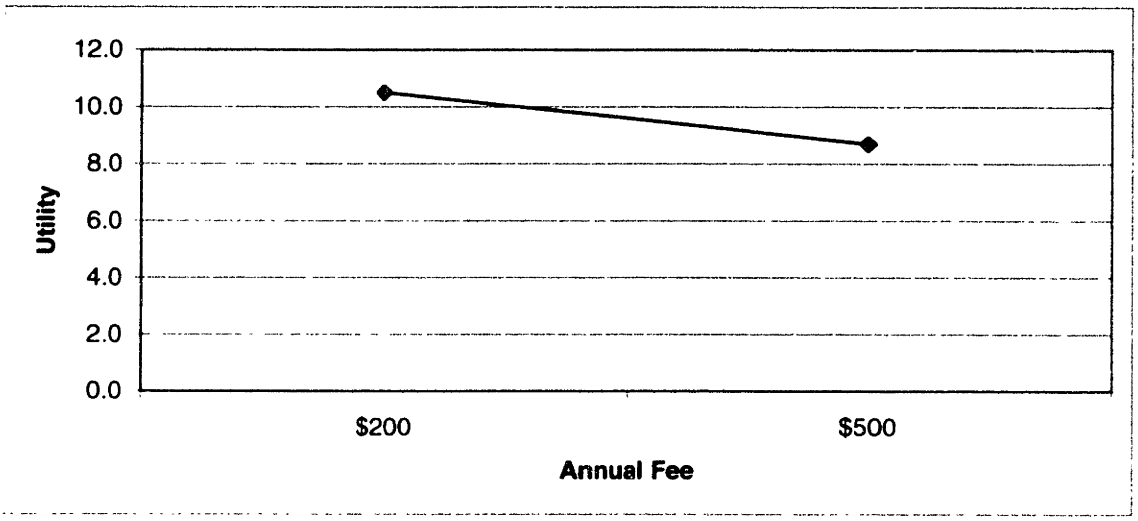

Figure 26. Utility of Annual Fee

Range of Content from adequate to insufficient: 14.9 – 3.8 = 11.1

Range of Content from new to obsolete: 10.5 – 8.6 = 1.9

Range from easy to hard to search: 11.7 – 7.1 = 4.6

Range of pay according to quality or amount of information customers hand in:

10.3 – 8.9 =1.4

Range of annual fee as $500 or $200: 10.5 – 8.7 = 1.8

Sum of the ranges: 11.1 +1.9 +4.6 +1.4 + 1.8 = 20.8

Content from adequate to insufficient: 11.1/20.8 = 53%

Content from timeliness: 1.9/20.8 = 9%

Easy to search to difficult to search: 4.6/20.8 = 22%

Pay according to quality or amount of information customers hand in: 1.4/20.8 = 7%

Annual fee: 1.8/20.8 = 9%

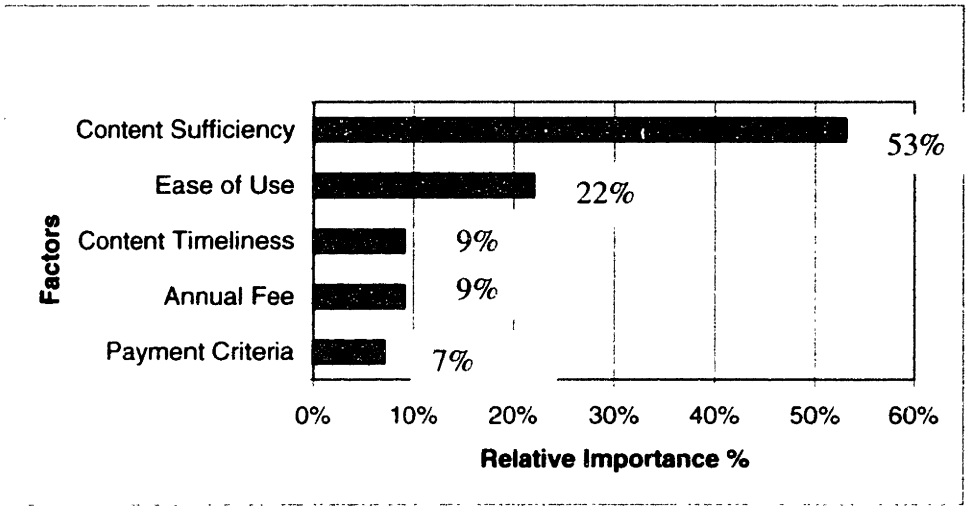

Figure 27. Relative Importance of Factors

As illustrated in Figure 3.6, since the content from adequate to insufficient occupied the largest portion of the total ranges (53%), it is the most concern of customers. Customers also concern about if the search is easy or not (22%). The next is that the content is timely or not (9%). The participants don't pay too much attention to the annual fee (9%) and the criteria of payment whether according to quality or amount of information customers hand in (7%). These are consistent to Figure 1 to 5, in which the larger of range, the more important that factor is.

From the utilities calculated above, we can also calculate the utility of best options for GSSD:

14.9 +10.5 +11.7+10.3 +10.5 = 57.9, from

Utility of Content adequate: 14.9

Utility of Content timely: 10.5

Utility of easy to search: 11.7

Utility of pay according to quality of information customers hand in: 10.3

Utility of annual fee as $200: 10.5

In summary, GSSD users prefer structured data and expert opinions in GSSD content. When they need knowledge about sustainability, asking experts is the first option, next is

to search online. Among the new functions of GSSD, customers prefer Digital Library, e-Publishing and Training Courses. The best options for new version of GSSD is content adequate and timely, easy to search, pay customers according to quality of information they hand in, plus annual fee for organization $200. This is a pilot survey, the result can be modified according to further survey with a larger target population.

Section 3.2 Security and Trusted System for e-Knowledge Commerce

The commodity traded in the e-Knowledge market is knowledge in digital forms, which is totally different from the tangible goods such as car in the conventional market. Economically, knowledge is non-rival goods, for which the marginal cost of its provision to an additional consumer is zero. Further, some knowledge online is nonexclusive goods, which people can't be excluded from consuming, so that it is difficult or impossible to charge for their use (Pindyck and Rubinfeld, 2000). This means that there are two kinds of knowledge online: public knowledge (nonrival and nonexclusive knowledge) and private knowledge (nonrival but exclusive knowledge).

To date there are a set of mechanisms in place to provide some protection. This section of the thesis reviews (a) copyright applications (i.e. for e-learning and per licensing); (b) security system and, particularly (c) digital trust systems.

Turning first to matters of copyright: Although private knowledge is protected by copyright, ambiguity and problems arise when the conventional copyright laws are applied into the cyber space and piracy become more and more popular with the exploding of e-Knowledge market. For instance, in the cyber space, the line between private and public knowledge is blurred, who has the copyright of the class notes in e-learning? Even worse, hundreds of Websites can provide software of Microsoft at a very minimal price or even free. The e-piracy is one of the most important barriers which can block the e-Knowledge commerce totally.

As discussed above with reference to e-Knowledge market, there are two layers of problems about intellectual property right need to be cleared and solved: First, the

ownership of IP, which is fuzzy in e-Knowledge market; second, how to protect IPR by methods of technology, policy and law. These problems have raised extensive debates and attentions among knowledge-buyers, copyright owners, and policy makers, making the copyright owners to hesitate to provide their digital works for e-knowledge commerce. Since e-learning is one of the most popular kinds of e-knowledge commerce, it will be discussed in details in the following, which can also be applied to other kinds of e-Knowledge commerce.

According to the Kaieteur Institute For Knowledge Management, 2000, the business e-learning market soars to be $80 billion. E-learning will become the largest delivery vehicle for corporate training and will soon enter the mainstream of training business activity. Facing the challenge from the e-learning companies, many traditional universities and colleges have also began to offer online education, such as Stanford University, University of California at Los Angeles (UCLA) and Indiana University. Stanford University runs a synchronous, interactive course for a virtual community with the students as many as 1600 in 1998. In OnlineLearning.net of UCLA, there are more than 8,500 students enrolled from all 50 states and 64 U.S. territories and foreign countries. Currently, the market for healthcare is about $1 trillion, which is relevant to everyone. But, with the development of the knowledge-based economy, more and more people need lifelong learning, so that the market of education including e-learning will exceed health care soon. Since e-learning is a novel area, a few work has been done about the intellectual property right in e-learning and many issues are still fussy.

According to the Copyright Act (http://www4.law.cornell.edu/uscode/17/), copyright protects the "expression of ideas". If the online discourse is an expression fixed in a tangible medium or not, is the critical criteria to check if it is suitable to be protected by the copyright law. The following discussion addresses first copyright issues related to elements in e-learning, and then those related to copyright licensing.

Copyright in e-Learning:

- **Email:** In e-learning, the assignments and questions/answers are all distributed by emails. The copyright of an email belongs to its author automatically. This does not mean that the sender always have the copyright of his email. For example, if he copies and sends other's work, he can't have the copyright. Sometimes, login certain systems require to waive the copyright of the emails or the content of email is for hire, which means the copyright of the email is not belong to the sender. As the recipient, receipt of an email does not mean he can do what he wants with this email. For instance, if he receives an email from an instructor to explain something to him, he can't distribute or post this email on any forum without the permission of the instructor (author). The safe way is to summarize the main content to avoid any copyright infringement.

- **Forum:** Posting a message on a forum is similar to email, whose copyright belongs to the author. Also, it is very possible to be illegal to repost one interesting message from one forum to another. But, repost a message from one area to another area in the same forum is legitimate. Sometimes, the forum asks the copyright must be waived for any message posted on it. Also, someone would like to waive his copyright and welcome everyone to repost his message in order to be distributed widely. The author probably requires the message to be reposted as a whole to maintain its original meaning. In this case, there can be a licensing between the author and the distributors. If the messages are collected and compiled, each message still belongs to its author. But, the collective work copyright maybe exists if someone acts as a moderator, who can claim the copyright of the collective work as a whole.

- **Live Chat:** When two persons chat on the phone, the words are not protected until they are fixed on any tangible medium, such as tape or paper. Similarly, the online chat is suitable to be protected by the copyright law, only when the content are fixed. If the text appears just long enough for the user to read it, no copyright exists. If the copyright is considered to exist, there will be trouble to explain

other similar phenomena. How about the voice transferring in the phone network? Is it fixed?

- **Newspaper and Magazine posted on BBS:** Since the copyright of the articles of newspapers or magazines belong to the authors, it is better to get the permission before post the articles on the BBS. Although the federal government can't have copyright for the official documents or publications, according to the Copyright Act, they can have copyright on the format, synopses, comments, etc.

- **Digital Image:** As books, the copyright of the pictures belong to the authors. In a case, one company purchased a digital picture and modified it. The Appeal Court in California held that the author not only had the copyright for the original digital picture, but also the copyright of the digital picture modified.

- **Digital Music:** MP3.com provides services (Beam-it and InstantListening) for the customers to input the digital music from their CDs into a database and download the music from the database. Only 36 hours after these services were set up, about ten thousand customers input or download 440 million songs. When RIAA accused it was piracy, MP3.com argued that it was fair use: it didn't make money from these services, just provided a service for the fans to exchange their music. But, it is hard to say nothing about commercial activity when such a large number of customers were attracted by these services to MP3.com. Up to date, in China, USA and German, this kind of service was already held to be illegal. Myplay, the competitor of MP3.com reached an agreement with RIAA, before it provided such services. Myplay agreed to check if the customers who used their service would involved in piracy or not, and pay royalty to authors and CD companies, so that avoid litigations.

- **Video:** The instructors of the e-leaning company teach the courses and are recorded simultaneously. The copyright of the tapes belongs to the company, due to "for hire". But, if one guest is invited to give a lecture, the company has to be

very careful to sign an agreement with the guest to clear the copyright and royalty. If the students watch the video online and record it then sell it to others, it's an infringement of copyright. It they just keep the video to review by themselves, it will be fine. To avoid this problem, it is recommended that the e-learning company provide video to be displayed by the order of students at anytime, so that no need for the students to record it.

- **Software:** Software can be protected by both of copyright and patent. Since patent protects "the embodiment and application of idea" for 17 years, while copyright protects "the expression of idea" for life plus 70 years. The software owner has to decide which one or both protections are necessary.

- **Textbook and Handout:** The copyright of any textbook and handout belongs to its author or the e-learning company, if it's for hire or purchased.

- **Class Note:** If the class note is written by student himself, student has the copyright. But, if students copy from the handout of the instructor, the instructor has the copyright. In real e-learning, the class note usually is a mixture of contents written by students or copy from instructors, it has to be determined case by case.

Copyright Licensing:

The application of current copyright law to the emerging e-learning using digital technologies has generated extensive debates and attentions among educators, copyright owners, and policy makers. The major issues involved are the recurring problems with digital licensing and the exemption coverage under the current copyright law in the digital context.

With respect to digital licensing, currently few digital licenses are requested or granted other than textual materials. Lack of request for digital licensing is mainly due to: Difficult to locate the copyright owners in a timely manner; Diversified licensing

procedures among educational institutions and copyright owners; Unreasonable licensing fees and terms. As a result, educational institutions simply avoid using the preexisting copyrighted works or seek exemptions under the copyright law as an alternative to licensing.

In terms of copyright exemption, Copyright Act Section 110(2) exempts certain performances or displays in the course of instructional broadcasting in the existing distance education. In particular, the display right exemption applies to all categories of works, while the exemption from performance right applies only to non-dramatic literary and musical works. In addition, it limits the nature and content of the transmission, and the identity and location of the recipients:

The performance and content of the transmission must be made as a regular part of systematic instructional activity by a non-profit educational institution or government body; It must be directly related to and of material assistance to the teaching content; It must be made primarily for reception in classrooms and places of instruction, or to persons whose disabilities or other special circumstances prevent their attendance in classrooms, or to government employees.

It should be noted that Section 110(2) has only limited applications to online courses. It would not exempt the acts of reproduction or distribution in the digital transmission. Further more, students that do not attend the class without special circumstances may not qualify as eligible recipients.

Fair use is the broadest and most general limitation on the exclusive rights of copyright owners. As it is technologies neutral and flexible, it will continue to be a critical exemption for digital education users. Although there is no case addressing the fair use doctrine for e-learning, four factors need to be considered in application: The subject matter of the course; the nature of the educational institutions; the ways in which the instructors uses the material; and the kinds and amounts of materials used. Ephemeral recordings exemption are in Section 112; the limitations on exclusive rights in sound recordings are in Section 114 and exemptions for certain secondary transmissions in

Section 111. Their applications to the e-learning are limited, and will not significantly expand the scope of the permitted instructional uses in a digital environment.

In terms of international issues – or issues that are significant in the international domain -- the major international treaties with the respect to copyright are the Berne Convention and the TRIPs Agreement, both of which govern the exception to copyright internationally. Any amendment for e-learning should be compatible with them. When an educational institution in the US transmits courses to students in other countries or vice versa, it is unclear which law will apply, making it harder for educators to determine what uses of works are permissible (U.S. Copyright Office, 1999).

Important stakeholder concerns are addressed. For example, both two parties, the educational community and copyright owners agree that fair use still applies to uses of copyrighted work in the context of e-learning, but they do not have a consensus on which digital education activities should be eligible.

The educational community, including educators and academic libraries, argues that law has to be changed to optimize the quality and availability of forms of digital education that takes full advantage of current technological capabilities. Their major concerns are:

1. Fair use is not clear enough in its application to the digital context.
2. Exemptions in Section 110 are outmoded and do not extend to the full ranges of activities covered by e-learning. For example, the current copyright law may discriminate against remote site students in their educational experience vis-à-vis on-site students; it may discriminate against new technologies vis-à-vis old ones.
3. Licensing is difficult to obtain from copyright owners.

They suggested the amendments to the current law as following:

1. Eliminate the concept of physical classroom as a qualification for exemption;
2. Extend the coverage of rights at least to permit digital transmissions; and

3. Expand categories of works by broadening the performance right exemption on works other than non-dramatic literary and musical works. The educators expressed the strongest concern on exclusion of audiovisual works, due to difficulties in getting licenses for digital use from motion picture producers.

   To control the potential risks of unauthorized dissemination of copyrighted works, educational communities are willing to make efforts to safeguard the security of the materials disseminated. They would educate students, faculty and staff about the copyright protection (U.S. Copyright Office, 1999).

Copyright Owners hold the view that statutory amendment is not necessary or advisable, and the fair use doctrine under current law is good to support the healthy and strong development trend of the e-learning. On the contrary, they are concerned that expanding the scope of exemption in Section 110 would harm their primary and secondary markets. In particular,

1. On specific instructional exemptions, they concern that broadening exemption would result in their losing opportunities to license works for use in the emerging e-learning market;
2. They are also concerned about the increasing risks of unauthorized downstream use of copyrighted works in digital context.

With respect to the concerns of government and Congress in the US, the issue of whether the law needs to be amended is complicated by big uncertainties in future technology and market development. Two critical questions need to be addressed: Will technologies capable of protecting copyright be available in convenient and affordable forms in the near future? Will licensing market evolve to ease the process and solve the current problems?

Many concerns stem from the inability of effective functioning of technological protections and licensing mechanisms. If technologies were developed to safeguard the protection, broadening exemption could be of less dangerous to copyright owners, since the risks of unauthorized downstream uses would be greatly reduced. If licensing

mechanisms were improved, broadening exemption could be less important to educators since they could rely on licensing to get access to copyrighted works. Although technologies do exist today, they have not been integrated into the networks of e-learning, partly due to cost and availability (U.S. Copyright Office, 1999).

Therefore, several principles should be followed to regulate the licensing in e-learning:

Emerging e-learning market should be developed with middle or minimal government regulation.

1. At some point, existing and dysfunctional markets may require government adjustment with the law.
2. Copyright law sometimes needs to be updated to accommodate technology development.
3. Copyright law will continue to maintain a proper balance of interest between educational institutions and copyright owners.

Hence, here are some suggestions to solve the licensing problems in the coming future:

1. Clarify the meaning of transmission to include both digital means and analog means.
2. Expand scope of rights covered to accomplish the digital transmission over computer networks.
3. Emphasize concept of mediated instruction. If an entire work can be viewed online repeatedly whenever the student chooses to or for an indefinite duration, the performance or display will be a perfect substitute to purchasing a copy. So mediated instruction should be emphasized to avoid it from happening.
4. Add new safeguards to counteract new risks in application of the exemptions. Any transient copies permitted under the exemption should be retained for no longer than reasonably necessary to finish the transmission. Those seeking to invoke the exemptions should be required to institute policies regarding copyright protection, and to inform the students, faculty and staff on copyright

law. Technological measures must be in place to control unauthorized uses when works are transmitted in digital forms.

5. Maintain existing standards of eligibility. An educational institution still needs to be nonprofit to be eligible for the exemption required under Section 110(2). However, the lines between for-profit and nonprofit are not longer clear-cut in the arena of online education, which is an evolving issue that deserves further attention.
6. Expand categories of works covered. The main categories of works that could be affected are audiovisual works, sound recordings, and dramatic literary and musical works. As the law must strike a balance between copyright owners and educational institutions, it is suggested making a compromise on this issue by expanding the categories while restricting the use in a limited way.
7. Add new ephemeral recording exemption. This will allow an educator to upload a copyrighted work onto a server, and to be subsequently transmitted to students enrolled in the course (U.S. Copyright Office, 1999).

It is necessary to clarify fair use doctrine, such as: Fair use doctrine is technology neutral and will continue to apply to digital environment; Lack of established guidelines for any particular types of uses does not mean that fair use is inapplicable; The relationship of guidelines to fair use and other statutory defenses should be clarified.

Although copyright licensing is not working so well currently in the e-learning, it does not justify abandoning or re-constructing the licensing system. The question is whether market is dysfunctional, and if so, to what degree that calls for government & congress regulation. As there is no sufficient evidence of a need for legislative solution, it will be better to give market leeway to evolve and mature (US Copyright Office, 1999).

Security System

This leads to the second major form of access-control: it is very important to protect digital work and other intellectual property from piracy by methods of technology, policy and law. Also, all the private information about customers such as name, address, credit card number, courses taken, record, etc. need to be protected. Security technology can

work in many ways, including to main methods of (a) limiting access and/or (b) controlling downstream uses, and/or (c) watermark.

First, with respect to limiting access, E-learning centers may constrain or prevent outliers (others, students, etc...) to get access to various content with different methods separately or in combination.

- **Server Security**: Two models exist to protect the server: a. All that are not allowed are denied, which means allowing certain machines to get in while denying all others. b. All that are not denied are allowed, which means denying certain machines and allow all other to get in.

- **Password**: Password protection is the most popular way for protection, which lets the e-learning center to have a gatekeeper. Once the student registered in an online class, she/he will have a username and password to that virtual classroom and other resources. There are different passwords to various classes. Password will expire after one specific period or after the student finishes her/his class.

- **Firewalls**: Firewalls are a system or group of systems that enforce a policy between two networks. There are two categories of firewalls: network-level firewalls and application-level firewalls.

  Network-level firewalls look at the packet header and see where it is trying to connect to, it then decides if it can pass or not, including router access lists and packet filters. Network-level firewalls are easy to figure, transparent to users, very fast, and cost effective, while have shortcomings: access control is based only on address/ports, logging is fairly simple, and must have a valid address range.

  Application-level firewalls look at the package and decide what the packet is trying to do and whether it is permitted or not, including address translation, proxy gateways, application forwarders, socks, firewall configurations, dual-

homed gateways, screen-host gateways, and screen-subnet gateways. Application-level firewalls are very fine access control, better logging, can be used with reserved or unregistered IP address ranges. However, the disadvantages of application-level firewalls are: harder to implement, performance is not as good as with a network-level firewall, each protocol requires special software, and not always transparent to users.

Since these two kinds of firewalls both have advantages and disadvantages, they can be used respectively or in combination, according to the specific requirements. In e-learning, firewalls are used to protect e-learning network. Hence, firewalls are created by the e-learning center server and located between the e-learning network and the public network to prevent unauthorized users to get access internal data.

- **IP Addresses/Domain Names**: By screening for only specific IP addresses or domain names, the content can be accessed to only the computers with sufficient authority, such as students' PCs at home or office. But, since e-learning center should be opened to students at anywhere and anytime, it's inconvenient to restrict the content by IP address.

- **Hardware Connections**: Connection can create a closed circuit to transfer data, which is not suitable for e-learning due to the same reason as IP Address.

- **Encryption**: While the methods discussed above focusing on preventing outliers to get into a network, encryption focuses on the transfer of digital work. The instructor can send the class materials such as videos, textbooks, assignments, etc. in the form of encryption, which can only be decrypted by students with the private key provided by the e-learning center.

Second, with respect to controlling downstream uses, after students log into the e-learning system or decrypt the digital work, can they do everything about the digital

work, such as download, print, make copies, or forward to others? Technologies that affect the downstream uses of protected works are intended to handle this issue, which restrict use of the digital work or detect and prevent unauthorized use.

Some technologies are designed for a special type of work (e.g., audio, video or text), and allow copyright owners to set rules for the use of their work. Basically, the technology encodes every copy of the digital work and wraps it in a proprietary file format that can be opened only by complementary software, which reads and abides by the usage rules contained in the file. The file format contains the conditions of access and rules of the use of the digital work, which specify who is allowed to use and the extent to use it. The complementary software resides on user's PC, which can identify the user and respond to the rules embedded in the container. It also acts as a viewer, allowing the user to watch or use the digital work, according to the embedded rules. If the digital work moves, the proprietary file format follows it automatically. So that the digital work can't be viewed or used by anyone else without the proper viewer and authorization. Some of these technologies are illustrated as following:

- **Adobe Acrobat Reader**: Acrobat is a system that includes a proprietary file format called PDF, a reader and software to create the secure document. The digital work owner can set privileges in the file, obeyed by Acrobat Reader. The owner may set limitations for the user to view, print, or copy the digital work.

- **Liquid Audio**: Liquid Audio is a secure container technology currently used to sell recorded music file online, which both delivers the music and accept the payment. After the customer see the cover or hear the sample, if he wants to purchase it, the digital music can be downloaded and marked with the buyer's unique player ID. Only the software obtained from the Liquid Audio and installed on the user's computer with a serially numbered identifier can open the encrypted music. The customer can only listen the music, without any rights to copy and distribute it.

- **E-book**: E-book is the device that is used for customers to read the digital work. E-book is designed to be one-way, only receive the digital work and can't transfer it to others anymore. It is designed like a book, with a capacity to store lots of digital books. In the new versions of E-book, readers can mark the sentences and write down notes. If the customer wants to lend the book to someone else, he has to lend the E-book totally, or the borrower will have the lent copy and the original copy will be locked for read, until it is returned.

- **InterTrust**: InterTrust can protect every kind of digital work as a secure container system. The digital work in InterTrust can be viewed and used through InterRights Point, installed on the customer's PC.

Third, is control of use through ' watermark'. The methods discussed above are all trying to prevent breaking into and pirating of the digital works. However, if the system is broken and the digital work is pirated, what can be done? Intellectual property laws investigate crimes and gather evidences for the eventual indictment and conviction of criminals. But, the criminals who pirate the digital work always trying to delete the information about copyright or author on the digital work. Dollar bills are protected by watermark, is it possible for digital watermark? The technology progress makes it possible. Digital watermark can be attached on any digital works either visibly or invisibly, containing the information about author, copyright, licensing terms, etc. Also, digital watermark can contain commands to prevent copying, distributing, etc. So that scanners, copiers, or printers will not scan, copy or print digital works according to the commands in the digital watermark. It has been testified that it is time-consuming and costly to find and delete digital watermark. Although a series of digital watermark products are available in the market, more improvement is necessary for commercial utilization in large scale. Another barrier is that when digital watermark will has a legal status on the court, since it took more than 20 years for digital signature to reach such goals.

Digital Trusted System

Third is digital trusted system based on integrating the technologies discussed above. The digital trust system is a system that follows rules governing the terms, conditions and fees to use digital works. Before any e-knowledge commerce transaction, the systems of customer and company have to check and establish that they are both trusted systems and determine their security levels and billing methods. For instance, when a student enroll and log into the e-learning system, the student's PC and e-learning server will check each other by the key system.

The public and private keys system guarantees the security between the computers. Each computer has private key being secret and public key being known. Anything encrypted by its private key can be decrypted by its public key, vice versa.

There are several kinds of online billing methods. Netbill coordinates purchases among customers, firms and financial clearinghouses, which keep the overhead of transaction aggregation and billing quite low. Since sometimes only members of an organization can get the discount from the firm, Digital licenses are helpful, which are digital certificates indicating membership in a group, class or organization. Digital tickets are similar to coupons distributed in any bookstore.

Three basic rights about digital work are viewing right (or playing), printing/copying right, and transferring right. To copy a digital work is to make a new, usable digital copy without deleting the original, while to transfer a digital work is to make a new usable copy and delete the original. Almost everything the customers can read, watch or hear can be recorded with degrade in quality. The trusted system is designed trying to prevent the large quantity of perfect copying for commercial use, which exists in two main devices: the E-book as discussed above and the trusted printer.

There are four elements in trusted printers to mark copies printed: print rights, encrypted online distribution, automatic billing for copies, and digital watermarks. When assigning rights to a digital work, the e-learning center utilizes a digital property rights language to

distinguish among viewing right (or playing), printing/copying right, and transferring right. The digital work can be encrypted in order to prevent from being stolen on the way from the e-learning center to a trusted printer. When the transfer is interrupted on the way, the sender recovers the original one and reports the failure of transfer. The trusted printer can only print the digital work, instead of transferring it to others any more. Also, e-learning center can set limitation about requirements and fees for the students to view or print the digital works. For example, students can print the digital work only twice with a certificate issued by the e-learning center. When the digital work is printed, the trusted system automatically logs the billing transaction. Finally, the trusted printer can mark the copy of digital work by watermark, such as the information about copyright, author, and the name of customer can be printed on the copy. If the students tries to delete the information of the copyright or break the trusted system in order to transfer the digital work to others, the trusted system will warn the students it is illegal at once, then it will delete all the digital work stored in it if the students continue the illegal actions.

Although the installment of digital trusted system (hardware and software) will cost the e-learning companies and copyright owners a lot, but only the digital trusted system can make the e-learning be possible and the market to grow smoothly. Furthermore, since the number of students in e-learning is much higher than the conventional classroom learning, the huge cost of digital trusted system will be divided to be very minimum to each student. The cost will be recovered when the market grow.

The trusted system does not exist in vacuum, but in a social framework. The trusted system is the technical methods to protect the digital work, while the law prohibits any piracy about digital work, as well as other intellectual property. In details, the laws prohibit any actions to delete the watermark about author, copyright, etc. and violation could result into fine and jail.

All of the modes reviewed and discussed above bear directly on the formation of future use-paths and patterns, restrictions and rights, and therefore must be take into account in future development of any internet-based system of exchange. They are especially

relevant to the case study in this thesis – the Global System for Sustainable Development – and to its new applications and innovations. The following chapter focuses on some important implications for further research.

Chapter 4. Conclusions and Recommendations for Future Research

This thesis began with a review of the development of e-knowledge commerce, a new and powerful addition to global commerce. As indicated at several points earlier, it is the convergence of three trends -- growth of knowledge-based economy, the diffusion of the Internet and Globalization—that created the opportunity for a Global Knowledge Network and the formation of a global e-knowledge market.

At this point, it is generally believed that the emerging e-knowledge market will grow to be a $1 trillion global micro-economy by 2010. Then, some main types of e-knowledge commerce – and some distinctive business models -- are discussed in details, such as e-learning, e-publishing & digital library, e-software, etc., which occupy the most of the share of global knowledge e-commerce. Especially, with the development of knowledge-based economy, life-long learning is more and more popular, since companies such as Motorola, will focus on life-long learning through e-venues. And, e-learning for young students in schools and for employees in industry will become the main stream of education, which will soon exceeds healthcare to the largest industry.

Since e-learning will also contribute to the growth of e-publishing and e-software. For reasons such as these, multiple business models for e-learning, e-publishing and e-software need to be explo further established, explored, and expanded.

In the coming years, with the development of wireless Internet technologies, Global Knowledge Network will provide services such as anybody, anytime, anywhere and any knowledge. Personal digital libraries are being established and could be accessed at anytime and anywhere.

As a case study, the Global System for Sustainable Development as a Global Knowledge Network is discussed in some detail, with a special focus on the role of new function, how knowledge is obtained about ways they are valued by potential customers, the new

functions needed (or requested by users), and how take into account some fundamentals of security when building d the new functions. Figure 28 shows the market space for GSSD.

The analysis in this thesis found that GSSD users prefer structured data and expert opinions in GSSD content. When they need knowledge about sustainability, asking experts is the first option, next is to search online. Among the new functions of GSSD, customers prefer Digital Library, e-Publishing and Training Courses. The best options for new version of GSSD is content adequate and timely, easy to search, pay customers according to quality of information they hand in, plus annual fee for organization $200.

The Global Knowledge Network does not work in vacuum, but work in society defined in terms of its policies and laws. However, the conventional copyright laws generates ambiguity and problems when they are applied to the cyberspace, it need to be solved with the improvement and combination of technology, policy and law. Otherwise, the piracy will become more and more popular and will block the growth of e-knowledge market totally.

In this connection, the analysis in this thesis focused on policy issues about copyright in e-knowledge commerce, and the technologies such as firewall, encryption, liquid audio, e-book, interTrust, watermark and digital trusted system to protect copyright in cyber space. With the development of e-knowledge commerce, a complete copyright protection system including technology, policy and law will evolve to work well in the coming future.

Based on the reviews, discussions, analysis, and results, this concluding chapter identifies some specific lines of research to push the work further in several specific directions. This thesis thus proposes five new directions and related activities:

First: A complete economic model for Global Knowledge Network should be established, which may need about one year of work. The new economic model could be developed

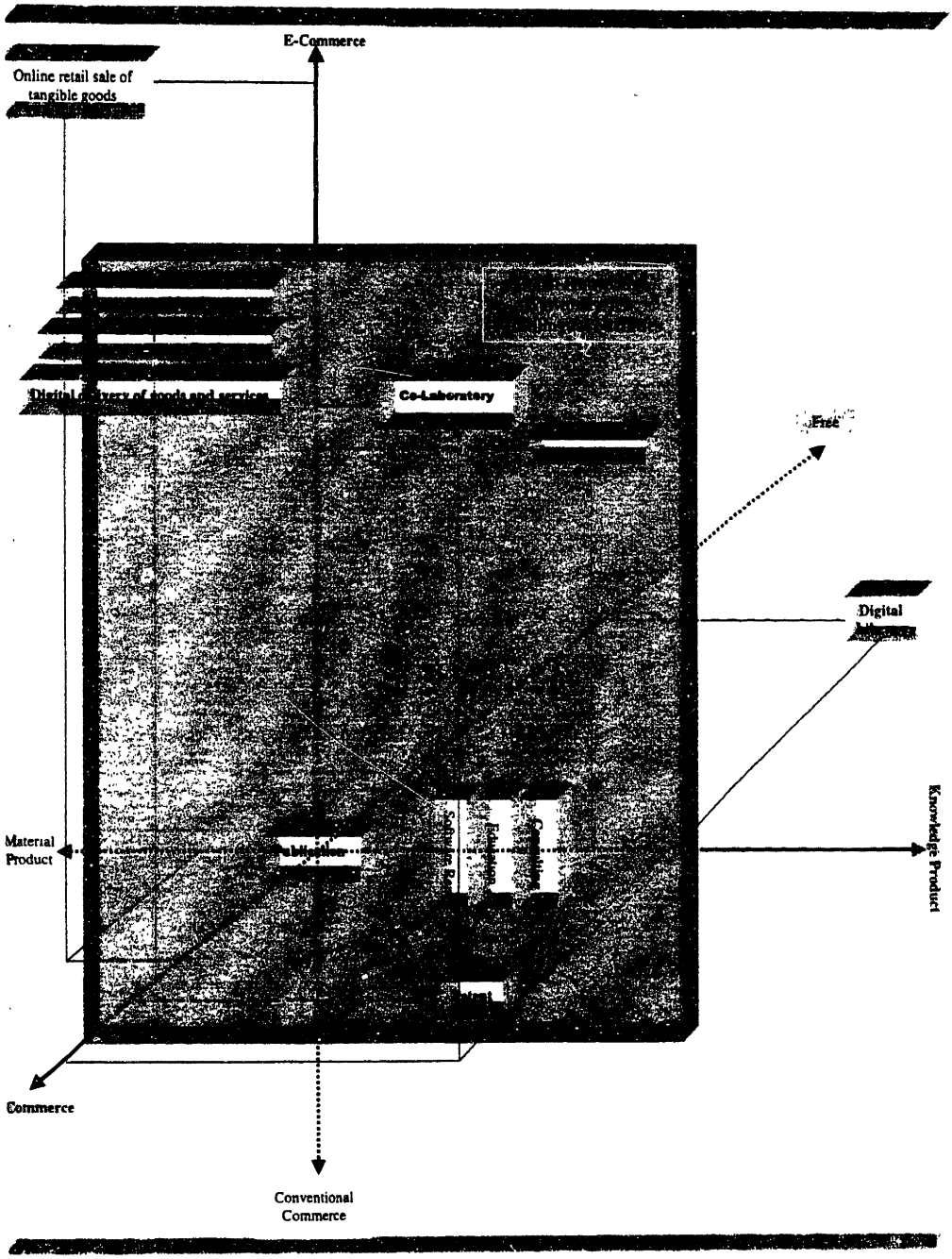

Figure 28. Global Commerce System

along the lines argued earlier in design for collaboration between MIT and Columbia University (drawing upon the model of Graciela Chichilnisky in Columbia University and the Global System for Sustainable Development as a case study of Global Knowledge Network in MIT) to integrate knowledge networking into 'mainstream' economic growth models (A research proposal is already written by the main researchers).

Second Although various e-networking exist, they need to be integrated into GSSD as a Global Knowledge Network in order to enhance overall functionality, introduce seamlessness, and enable them to work well together. Some special software and device need to be developed. The development work of GSSD needs to include multiple functions of e-knowledge commerce which could be very helpful to help establish the new economic models required in such cases of e-learning, e-publishing, etc.

Third. Since e-knowledge commerce and Global Knowledge Network are still new initiatives, more and more new business models need to be explored in the evolution of, and with the guidance of, actual practice over time.

Fourth. For any Global Knowledge Network to work smoothly, the policy system especially about copyright should be developed and customized to the needs and features of each Global Knowledge Network. The arguments about the exemption of copyright need to be addressed by government, or by the legislature, depending on the evolution of e-knowledge markets (and overall commerce worldwide).

Fifth. Global Knowledge Networks will increasingly penetrate into the developing countries, as well as developed countries. More data are necessary to analyze and compare the similarities and differences in operations of GSSD – as a Global Knowledge Network—to increase our understanding of differences between developing and developed countries.

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