National Program for e-Learning in Taiwan

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ABSTRACT

Taiwan government has initiated a five-year program since 2002: the National Science and Technology Program for e-Learning. The national program started from 2003 and was completed at the end of year 2007, involving thirteen government agencies. This paper describes the results that the national program has accomplished at its first phase, 2003 to 2007. The results include how the national program has helped enhance competitiveness of commerce; improved public welfare in Taiwan; and how the national program has stimulated the research outputs in both industry and academia.

Keywords

Taiwan National e-Learning Program, Digital learning, e-Learning development strategies, Academic and industry developments

Introduction

Many developed and developing countries have currently allocated funds and resources to encourage researches in e-learning with a view to gaining profits it can bring (Hwang, 2003). In Europe, the Commission of the European Communities (2001) announced the guideline of e-learning policy, The e-Learning Action Plan-Designing tomorrow's education; the Secretary of Commerce in the United States (2002) published "2020 Visions-Transforming Education and Training through Advanced Technologies" report; and, Taiwan government has also planned a five-year national program for e-learning in 2002 National Science & Technology Program for e-Learning, 2002).

The national program, National Science and Technology Program for e-Learning, started from 2003. The major objective of the national program is to increase happiness among common citizens via e-learning, for example, students may feel happy if they get good grades or get permission from their favorite universities; parents may feel happy if their children have good performances at school; business managers may feel happy if they cut down the cost of human resource training; workers may feel happy if they get promotion and raise of salary; moreover, learners may feel happy if they can study the topics they're interested in. There are still two goals for the program to accomplish: broaden knowledge among people and enhance national competitiveness.

Thirteen government agencies have joined the national program, each in charge of different aspects of promoting e-learning, for example, e-learning can be applied to business and enhance competitiveness; improve public welfare; help develop new learning technologies, methodologies, systems, and tools. Regarding enhancing commercial' competitiveness, the national program assigns Industrial Development Bureau of Ministry of Economic Affairs (MOEA) and Industrial Technology Department of MOEA to the conduction; improving public welfare, the national program has Council of Labor Affairs, Ministry of Education, Council for Culture Affairs, Council of Indigenous Peoples (joined since 2005), Council for Hakka Affairs (joined since 2005), Bureau of Health, and National Palace Museum (is considered one of world's great museum; Japan Aerospace Exploration Agency, 2005) perform the conduction; doing e-learning related research in both industry and academia, Industrial Technology Department of MOEA and National Science Council are involved.

Currently, there is no national e-learning program promoted by government around the world. Most large e-learning programs are supported by research organizations, non-profit organizations, and corporations; furthermore, it is rare that an e-learning program involves so many government agencies as the national program for e-learning in Taiwan does. This report reveals the way of promoting e-learning from the viewpoint of the government. Moreover, it reveals how such kind of national program succeeds in helping corporations enhance competitiveness, improving public welfare in Taiwan, and stimulating the research outputs in both industry and academia. However, there are

still some issues for the government to solve when promoting e-learning; different participating government agencies may have different viewpoints and expectations to e-learning, and the government needs to sort out the best way for agencies to work together. This paper will be a good reference and source for other countries when trying to promote e-learning.

This paper first describes the details of the national program for e-learning in Taiwan in Section 2. Section 3 shows how the five-year national program improves public welfare. Furthermore, the program has enhanced competitiveness of not only the industry in e-learning but also many other industries. Section 4 gives the examples of how the national program has enhanced economical competitiveness in different industries. Section 5 illustrates the research results in two ways: the industrial patents and the academic papers. Finally, a simple conclusion is made in Section 5.

National Science and Technology Program for e-Learning

Via e-learning, services, information, knowledge and policies are delivered from government agencies to the public more efficiently. Applying e-learning to the organization, corporations may cut down time and budgets in training employees, increase employees' learning efficiency, and reduce the divide in professionalism. Educational and training organizations can help learners improve learning efficiency and teachers teach more efficiently via information communication technologies (ICT) and digital technologies of e-learning. According to these benefits and technological trends, Taiwan government initiated the national science and technology program for e-learning in order to equalize the opportunity for learning among common citizens, promote e-learning industry, and increase commercial competence in Taiwan.

National Science and Technology Program for e-Learning is a five-year program since Jan. 2003. The first phase lasts from 2003 to 2007 and the National Science Council has also planned the second phase, the promotion phase (2008-2012). There are seven operational programs in ELNP, including "e-learning for everyone", "narrowing the digital divide", "mobile learning devices", "internet-based industrial park for e-learning (e-learning park)", "advanced e-learning technology R&D", "fundamental research on learning and cognition in e-learning", and "policy guidance and manpower cultivation".

Table 1 lists the total budgets for the national program from 2003 to 2007. Every agency has put all efforts to make the final budgets meet what's planned.

Table 1: National Program Budgets (in Million USD)

Year	2003	2004	2005	2006	2007	Total
Planned	25.7	27	27	27	27	133.7
Actual[+]	20.58	25.61	24.59	19.63	20.33	110.74

[+]final government budgets

Thirteen government agencies were involved in the national program, the twelve government agencies were National Science Council, Industrial Development Bureau of MOEA, Industrial Technology Dept of MOEA, Ministry of Education, Ministry of National Defense (from 2003 to 2005), Bureau of Health, Council of Labor Affairs, Council for Culture Affairs, Council of Indigenous Peoples (since 2005), Council for Hakka Affairs (since 2005), Tainan County Government (from 2003 to 2005), Overseas Compatriot Affairs Commission (2007), and National Palace Museum. The seven operational programs aim at three goals: to equalize learning opportunity for people; to increase commercial competence in Taiwan; to enhance quality of academic researches and development of industrial technology in e-learning.

The government sets three goals for the national program. And many government agencies have participated in the national program, each having different subjects and emphasis. For example, Council of Labor Affairs aims at workers and the unemployed to help them get jobs; MOEA focuses on helping commercial competence through e-learning and e-learning industry get orders from corporations around the world; National Science Council emphasizes on enhancing the quality of academic researches and how to put the results in practical use. For better

cooperation among the agencies, the national program divided the agencies into different goal groups, and each is asked to integrate expected yearly outcome and reach mutual support.

The national program divided the participating government agencies into three goal groups:

1. equalizing opportunities for learning
    - Ministry of Education (MOE)
    - Ministry of National Defense (MND, from 2003 to 2005)
    - Bureau of Health (BOH)
    - Council of Labor Affairs (CLA)
    - Council for Culture Affairs (CCA)
    - Council of Indigenous Peoples (CIP, since 2005)
    - Council for Hakka Affairs (CHA, since 2005)
    - Industrial Development Bureau of MOEA (IDB of MOEA)
    - Tainan County Government (TCG, from 2003 to 2005)
    - Overseas Compatriot Affairs Commission (OCAC, 2007)
    - National Palace Museum (NPM)
2. enhancing commercial competence in Taiwan
    - Industrial Development Bureau of MOEA (IDB of MOEA)
    - Council of Labor Affairs (CLA)
3. enhancing the quality of academic researches and development of industrial technologies in e-learning
    - National Science Council (NSC)
    - Industrial Development Bureau of MOEA (IDB of MOEA)
    - Industrial Technology Dept of MOEA (ITD of MOEA)
    - Ministry of Education (MOE)

The national program required complementary collaboration among agencies, for example, MOE developed the standard operating procedure (SOP) of instruction design for e-learning courses and materials, and this should be the reference for other agencies; CLA, BOH, and NPM, developed numerous high quality e-learning courses and materials, other agencies such as TCG could resort to it directly; CHA set up a certificate for Hakka language competence and BOH a certificate for medical personnel, CLA could apply regulations to it; IDB of MOEA built an e-learning park gathering many corporations involved in the industry and provided high-quality e-learning products and services, all agencies could resort to the products and services provided by the e-learning park.

Two of the seven operational programs, "e-learning for everyone" and "narrowing the digital divide", are relevant to the public welfare improvement; another two operational programs, "internet-based industrial park for e-learning (e-learning park)" and "advanced e-learning technology R&D", are relevant to increase business competitiveness. Furthermore, the "advanced e-learning technology R&D" and fundamental research on learning and cognition in e-learning" operational programs are relevant to the researches corresponding to industry and academia. This paper mainly focuses on the outcomes of these five operational programs.

Regarding public welfare improvement, the national program plans on six steps of execution: improving laborers' professionalism; narrowing the digital divide among laborers such as disabled workers and the unemployed; cultivating e-learning related professions; broadening knowledge among citizens, as government agencies provide chronic diseases e-learning courses and Chinese culture/artifacts e-learning courses; increasing professionalism community reconstruction designers; and increasing aboriginal people's learning opportunity. The national program provides workers continuous learning to enhance their working skills, get promotions, and increase their wage; prepares the unemployed for satisfying jobs; aids students in academic achievement and permission into the schools they want; equalizes the opportunities for learning and working among the disabled, aborigines, and common citizens.

Regarding commercial competitiveness, the national program gets help from MOEA: the Industrial Technology Department keeps doing researches and developing advanced learning technologies. Moreover, the Industrial Development Bureau draws many corporations in the e-learning industry to form a virtual science park in order to complete the e-learning supply-chain. Via aid of the supply-chain, e-learning industry can provide integrated and

complete services for the increase of commercial competence; commercial competence in various industries can improve through high quality e-learning products and services.

Regarding the researches in industry and academia, the national program assigns the Industrial Technology Department to learning technology related researches and developing patents; and the National Science Council not only offers funding for researchers in academic organizations, but also encourages the cooperation between academic researchers and industries in order to realize research results.

The national program has created 108 KPI items and divided them into 10 major dimensions in order to acquaint people and government with the quantitative outcomes of the national program. This paper shows some major quantitative KPI results and some qualitative cases about how this five-year national program promotes the public welfare, increases commercial competitiveness in both e-learning related and ordinary industries, and e-learning research results.

Public Welfare Improvement

As mentioned in Section 1, seven government agencies have participated in the operational program, "e-learning for everyone". Every agency has their targeted people. For example, Council of Labor Affairs mainly targets people who have been employed or unemployed and disabled workers; Ministry of Education mainly focuses on students in traditional education system and on job development people; Council for Culture Affairs mainly targets community reconstruction and cultural designers; Council of Indigenous Peoples mainly targets aboriginal people; Council for Hakka Affairs mainly targets Hakka people; Bureau of Health targets not only medical professionals but the public; and National Palace Museum also targets the public.

Quantitative Results

Two KPI dimensions, public promotion and e-learning, are used to represent "e-learning for everyone" operational program. The public promotion dimension demonstrates how many people might know of the national program for e-learning in Taiwan and what e-learning really is. As we can see from Table 2, in the five years the national program has held 378 public activities and the total participants add up to more than two millions (2,474,962).

The age range of participants falls mainly between 12 to 50 years old, and curiosity might be the reason for more participants in the first year. In the third year, 2005, public promotion project was held by the Taipei Computer Association, which is the most important computer association in Taiwan and had held the Computex exhibition several times. The exhibition has involved project presentation, governmental demonstration, and product marketing in attracting people's attentions. Thus the participant number was raised so much in 2005. In the following year, in 2006, the participant number dropped again.

Table 2: KPI (Public Promotion)

Item	2003	2004	2005	2006	2007
Newspaper	58	121	147	303	323
Public Activities	41	28	87	130	92
Participants	23,448	205,572	1,950,332	203,197	92,413

The e-learning dimension shows how many e-learning websites have already been built (and most of them were free); how many people have been visited; how many courses have been developed; and moreover, how many items have been constructed. For the five years, 45,507 e-learning courses have been developed in over hundred e-learning websites, listed as table 3. Moreover, these e-learning courses also attract nearly eighteen millions (17,450,981) visiting counts to those e-learning websites.

While promoting the e-learning courses, the strategy is to acquaint people with the best practices. There are hundreds of thousands of mid- and small-scale enterprises, and correspondent industrial associations in Taiwan. The top one thousand enterprises have been selected as the promotion targets and the national program has helped them with in-house e-training materials. The national program sets up many courses to establish the industrial learning network for

business purposes; hence, there are 85,211.5 hours of e-learning materials in 2004 consequently. In 2005, the national program spreads the experiences to various industries suchlike fishing industry, farming industry, and manufacturing industry. Thus the e-learning material hours in 2005 dropped down hugely but the course number still increased from 2004's 8,777 to 2005's 20,431.

Table 3: KPI (e-Learning)

Item	2003	2004	2005	2006	2007
Websites	31	58	43	53	120
Visitors	220,930	3,487,451	5,675,808	3,883,249	4,183,543
Courses	153	8,777	20,431	307	15,839
Hours*	320	85,211.5	16,150	9,079.67	82,566.2
Items+	1,032	2,634	2,006	213,821	110,647

*total e-learning course hours
+in item bank

In the forth year, 2006, the national program focused on the assessments and the development of item bank. The assessment was used to improve the quality of e-learning course and to be the proof of offering people certifications. That's why items of 2006 exceeded year 2005 by a hundred times.

In details, Council of Labor Affairs has developed 145 courses in five categories; Ministry of Education has developed 54 courses (equals to 364 hours); Council of Culture Affairs has developed 102 courses in ten categories; Council of Hakka Affairs has developed 72 courses (equals to 432.5 hours) in seven categories and 12 hours of children e-learning courses; Council of Indigenous Peoples has developed 56 courses; Bureau of Health has developed 76 courses (equals to 171 hours) for introducing ten major diseases in Taiwan to medical professions and the public; and National Palace Museum has developed 63 courses in seven categories and there are 15 courses in English.

Council of Labor Affairs announces an online testing system for professional certificates, people can get a better perception of their capability through the online simulate test. The online testing system has attracted more than 2.38 million visitors up to Sep. 2007. Council of Hakka Affairs builds Hakka language ability exam and related certificates for Hakka people. Council of Indigenous Peoples also sets up exams for language skills and related certificates of aboriginal languages, including forty aboriginal dialects in Taiwan. Furthermore, Bureau of Health has issued 2,909 medical training certificates, including training hour certificates to the publics and the civil servants (1,097 certificates), and the continuous education certificates to medical professionals (1812 certificates).

Qualitative Cases

Council of Labor Affairs develops e-learning courses and special e-learning website for disabled people. These courses help disabled people learn working skills and improve their personal competitiveness. Ministry of Education cultivates elementary and secondary school teachers in godforsaken places through e-learning courses. Bureau of Health helps the general public, no matter where they are living, getting preventive care and self care knowledge. National Palace Museum has more than 650,000 artifacts covering 7,000 years of Chinese history and has developed a series of e-learning courses in multiple languages. The e-learning program of NPM offers the public opportunity to 'touch' Chinese arts and culture virtually, furthermore, to learn the related knowledge about the collections online.

Furthermore, there are two cases that can represent the qualitative results in the public welfare, Mr. Arnold (nickname) and Mr. Wu's cases. Arnold is a young person who does not have high school degree and Mr. Wu is a salesman currently working in a frozen fish company, Gallant Ocean Group. They all get successful experiences via the national program.

Arnold is a person who used to do nothing but hanging out around the neighborhood; he doesn't have high school degree. He found the Cultural Affairs School of E-learning (CASE) when browsing the web pages. Arnold was attracted by those blended courses provided by Council for Cultural Affairs and decided to apply the online school. His semester project was saving a hydrographic station during Japanese colonial period. After Arnold studied in CASE online school, he became a community reconstruction designer and had many cases in his hands.

Mr. Wu was a book salesman before he joined Gallant Ocean Group. He didn't have any knowledge about frozen fish. Gallant Ocean Group built an e-learning environment for its employees. A salesman like Mr. Wu needed to learn knowledge before they visited their customers. Wu learned a lot from the e-learning courses, and he did so well that his customers thought he had been working in frozen fish business in his whole life. Mr. Wu became the number one salesman three months later after he joined Gallant Ocean Group.

Increasing Business Competitiveness

Figure 1 represents the market size of Taiwan e-Learning industry from 2002 to 2006. As we can see from Figure 1, before the national program for e-learning started, the market size was only 22.64 millions USD. Although the market size was growing steadily, after the national program started from 2003 the market size grew extremely fast.

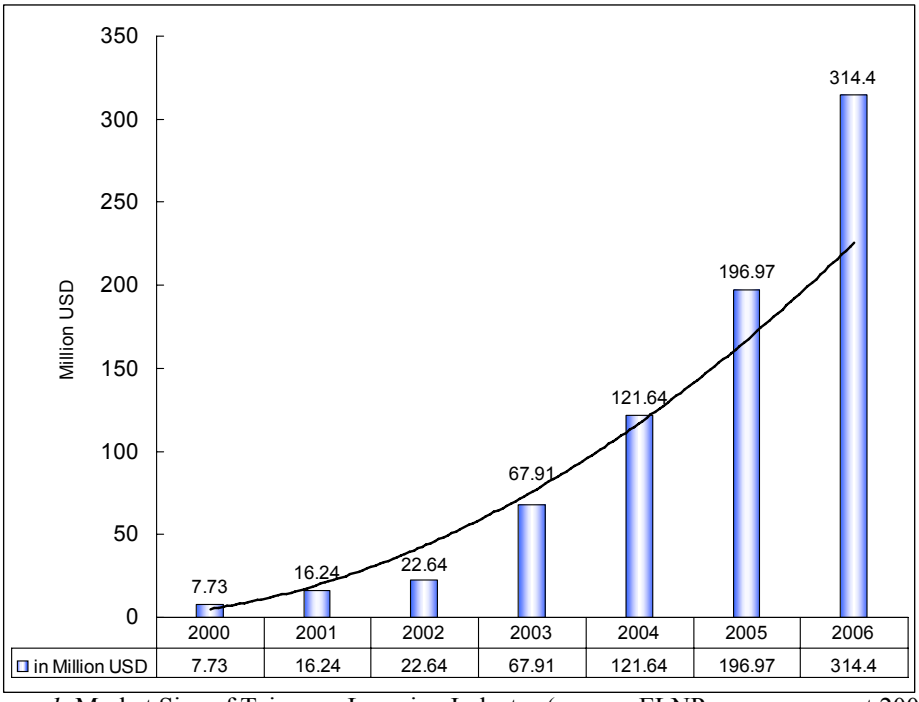

Figure 1. Market Size of Taiwan e-Learning Industry (source: ELNP progress report 2006).
(note: the national program started from Jan. 2003)

The Economist Intelligence Unit and IBM also conducted an e-Learning readiness white paper in 2004, in this report Taiwan sat on the 16th around world among 60 countries and was in 3rd place of Asia just behind the South Korea and Singapore (Economist Intelligence Unit & IBM, 2004). What's notable is that e-Learning readiness of Taiwan in the business part was in 9th place of the world.

Quantitative Results

There are two KPI dimensions related to e-learning industry, professionals and economics. The industrial part of professionals lists how many multimedia instructors have been trained by the national program; how many instruction designers have been trained; how many multimedia developers have been trained; and how many IT professionals have been trained. Table 4 indicates that there are more than a thousand (1,142) instruction designers have been trained. In general, an e-learning course development team always has one instruction designer, two multimedia developers, and four to five IT professionals.

Course Planners are the first line personnel. The national program set up the curriculum in 2004 particularly to boost the development of e-learning. The number of the course planners in 2004 was increased to 209, but then decreased

gradually in the following years. The number of cultivated instructional designers was similar to the course planners number. In 2006, the instructional designers added up to 542 because the National Palace Museum needed hundreds of instructional designers to help them transfer digital archives into e-learning courses.

Table 4: KPI (Professionals – industry part)

Item	2003	2004	2005	2006	2007
Multimedia Instructors	3	68	38	206	442
Course Planners	31	209	83	137	113
Instruction Designers	61	168	26	542	345
Multimedia Developers	32	51	354	97	70
IT Professionals	2,025	2,047	2,671	31	62

In the third year, 2005, the national program focused on having more multimedia developers because e-learning courses and instructional designing require multimedia development. There were many e-learning professionals learned in the two skills mentioned previously in first year and in the multimedia development skill in second year. The number of cultivated IT professionals in the forth year dropped down immensely because the IT talent training program had come to a halt.

The KPI items in economical dimension represent how many e-learning ISPs have been assisted by the national program and how much expenditure have been spent in applying e-learning. Regarding the expenses in Table 5, in the beginning, most enterprises kept a wait-and-see stand. One year later, some successful examples urged them to invest in their in-house e-learning training materials. Commercial expense for e-learning in 2004 was almost ten times than 2003. However, in the third year, 2005, most enterprises which wanted to invest in e-learning had already got involved, hence, the expenditure dropped down from 37.23 to 1.76. The phenomenon was also affected by the government awards. In 2004, the national program launched a three-stage reward mechanism and conferred the reward to the enterprises which were eligible for the reward requirements. In 2005 and 2006, the reward scale reduced and might affect the investing willingness in e-learning among enterprises.

Table 5: KPI (Economics)

Item	2003	2004	2005	2006	2007
Assisting[+]	29	47	55	49	27
Business Expenses[$]	6.22	37.23	1.76	7.93	1.75
e-learning Market Size[$#]	67.91	121.64	196.97	314.4	N/A

[+]assist how many e-learning ISPs
[$]in Million USD
[#]data comes from Market Intelligence Center (MIC) of Institute for Information Industry, Taiwan

Before the national program started, the e-learning market size was small; the quality of e-learning materials and services was not good enough; only one enterprise was involved in developing e-learning contents, and yet the quality of contents could not reach the standard of international market; there was no e-learning portal; there was no standards for either e-learning platform or e-learning contents; and there was no e-learning centers.

Now, the e-learning market size is around 314 millions USD; there are eighty-nine e-learning venders certified for the quality of their e-learning contents; many e-learning industries have started to get orders all over the world, including the US, Japan, Korea, Thailand, India etc.; there are five e-learning portals with more than 3,500 courses and more than 320 thousand members; the interoperability is greater than 85% with SCORM standard; and there are 86 e-learning centers now.

Qualitative Cases

Due to the promotion of national program, industries have shifted from the ignorant to positive executants. Moreover, the decision process has also been shortened from "six moths" to "three months", which means applying e-learning to business can gain more profits. Taiwan is also the first nation which got ADL SCORM certificate and ASTD ECC quality certificate.

Following are two successful cases from the national program. The first case is Family Mart Co., Ltd. and the second case is TransAsia Airways. Family Mart, a chain convenience store, was introduced into Taiwan from Japan in 1988 and now has more than 2000 stores in Taiwan. TransAsia was established in 1951 and wanted to become the best domestic airline as well as a globally renowned airline in the Asia-Pacific region.

Family Mart has so many stores in Taiwan. Employees in the chain stores are mostly students doing part time, so the corporation usually invests much expenditure in personnel training. Besides, in order to compete with other similar chain stores in Taiwan, Family Mart has to come up with new lunch meals every two to four weeks. The problem is how to get all employees well-trained before a new lunch meal is releasing.

Family Mart took e-learning as a good methodology to provide employees fast and cheap on-job-training (OJT). Therefore, since 2003 Family Mart developed e-learning platform and courses for fast delivery to employees. Now whenever a new promotion is released, there's no need to summon all managers or store representatives for conference. Family Mart delivers related e-learning materials directly to every store and saves a lot of budget for the company and a lot of traveling time for employees. According to Family Mart's estimation the opportunity cost of on-job-training was saving approximately more than 39 thousands USD in total (around 50% cut-off of budget) yearly as Table 10 shows.

Table 6: Opportunity Cost (in thousands USD/yr)

Item	Opportunity cost
Legal Personnel	Save approximate 9.15/yr
Staffs	Save approximate 7.32/yr
Part-time students	Save approximate 22.86/yr
Total	Save approximate 39.33/yr

The number of passengers traveling by air has recently fallen due to the increasing price of gas and the new high-speed railway. To increase competition and adapt to the market environment, Porter (1997) recommended that corporations should first reduce cost and provide various services. Regular training requires a large expense for an airline. Therefore, to reduce the cost of training, TransAsia decided in 2004 to replace traditional training with e-learning.

TransAsia developed 60 e-learning courses, including 36 courses (lasting about 80 hours) produced in-house. According to TransAsia's estimation, it might save up to 800 thousand USD in total yearly as Table 10 shows (Chuang *et al.*, 2008).

Table 7: Opportunity Cost (in thousands USD/yr)

Item	Opportunity cost
Flight Crews' Salary	Save approximate 340/yrs (save training time, increase flying time)
Operation Earnings	Save approximate 840/yr (will be able to have additional flights)
Lecturers' Expenses	Save approximate 20/yr (do not need to spend money for lecturers)
e-learning Expenses	Spend approximate 400/yr (course development, infrastructure construction, learning management system, e-learning website etc.)
Total	Save approximate 800/yr

TransAsia not only received the government reward (approximately sixty thousand USD), but was also named a winner (bronze medal) in the Innovative Technology Category in the 2005 Brandon Hall Excellence in Learning Awards.

Stimulating Researches

As we all know, promoting e-learning industry requires high quality e-learning products. There's always know-how for high quality products. At this moment, the academic researching outputs are taking place. Three KPI dimensions here are used to evaluate the academic outcomes of the national program, which are academic dimension, international dimension, and professional dimension. Moreover, this section also shows evidences about how many patents and innovations have been applied, received, and made by the national program; how the program helps corporations with technological transferring from MOEA; and how much that the government has gotten back from industry while putting the investment into the national program.

Quantitative Results

The academic dimension shows how many SSCI/SCI EI journal papers and conference papers have been granted by National Science Council and published; how many industry cooperative projects have been initiated; how many professors and degree holders have joined NSC e-learning research projects; and moreover, how many future researchers and/or developers, that is, Ph. D students and Master students, have been involved in NSC research projects. Table 8 shows there are 355 SSCI/SCI/EI journal papers, 365 national journal papers and that 1,249 conference papers have been published already; and, there are more than 220 professors and Ph. D holders run NSC e-learning research projects this year.

Table 8: Research Results KPI (Academic)

Item	2003	2004	2005	2006	2007
SSCI/SCI/EI	32	78	88	73	84
Nat'l Journal	75	63	70	89	68
Int'l Conf. Paper	85	133	75	189	160
Nat'l Conf. Paper	114	138	145	105	105
Industry cooperation	9	18	21	18	13
NSC projects	69	88	77	56	56
NSC project chairs	234	209	216	176	195
Other Ph.D holders	41	26	45	16	28
Ph.D students	60	110	108	85	74
Master students	303	401	411	215	190
RA – Master	64	84	70	60	58
RA - others	213	183	226	81	104

The international dimension demonstrates how many important international e-learning conferences have been held in Taiwan; how many e-learning related experts, scholars, and organizations have been invited to Taiwan for discussion and giving talks; and also, how many e-learning international activities such as international conferences that Taiwan government has funded. Table 9 shows that Taiwan held IEEE Wireless and Mobile Technologies in Education (WMTE) in 2004, Computer Supported Collaborative Learning (CSCL), IEEE International Conference on Advanced Learning Technologies (ICALT) in 2005, Intelligent Tutoring System (ITS), and IEEE System, Man, and Cybernetics (SMC) in 2006 for the last 3 years.

Table 9: Research Results KPI (International)

Item	2003	2004	2005	2006	2007
Int'l Conf (to hold)*	1	2	2	2	8
Guest Inviting+	41	17	1	0	6
Participating Int'l Activities	76	69	12	11	5

*IEEE WMTE, CSCL, IEEE ICALT, ITS, IEEE SMC, APEC

+including experts/scholars/organizations

Following the academic dimension, the professional dimension could be divided into academia and industry as listed in Table 4 and Table 10. The professional dimension lists how many research assistants have been hired for the national program; how many students have gotten their master's degree; and, how many students have gotten their PhD degree. Table 6 shows that 1,778 students have got their master's degree in the first phase (2003-2007) and 789 students their PhD degree.

Table 10: Research Results KPI (Professionals – academia part)

Item	2003	2004	2005	2006	2007
Research Assistants*	362	532	921	772	577
Masters	269	430	512	528	389
PhDs	153	201	210	102	79

*research assistant number might be overlapped in different years

Industrial Technology Department of MOEA takes charge of the advanced learning technologies researching and development. The task involves developing new technologies and innovative ideas. Table 11 shows that how many innovations have got patents; how many patents have been received (as we all know that the reviewing process for patent usually takes one to two years); how many patents have been taken into production; how many corporations have been asked to transfer the invented technologies; and how much they have been paid by the government for transferring these technologies.

Table 11 shows that 75 innovations around the world have got patents, and 19 patents have been received. In the technology transfer statistics, 70 corporations have been asked for transferring 78 technologies from the government and have paid more than 1,568 thousand USD for the technologies. The reward of technology transfer has only been 1,100 thousands USD in the past four and half years, to the roughly budget of IDB MOEA, 1,600 thousand USD each year. Although the reward is not much, it is still growing up according to Table 11. And also, the purpose that Taiwan government proposes the five-year national program for e-learning is to stimulate and establish the e-learning industry rather than gain profits.

Table 11: Research Results KPI (Technology)

Item	2003	2004	2005	2006	2007
Patent (applying)	19	19	11	11	15
Patent (received)	0	5	2	3	9
Patent (products)*	1	7	10	8	12
Innovation+	1	6	2	0	3
Technology Transfer	13	16	23	11	15
Transfer Business#	5	13	23	14	15
Transfer Money$	177.43	270.03	511.63	220.87	388.55

*e-learning products according to patents
+including innovative systems/tools/modules
#how many businesses asked for technology transfer
$in Thousand USD

Qualitative Results

Taiwan has held many important academic activities in the past four years, for example, IEEE Workshop on Wireless and Mobile Technologies in E-learning 2004, Computer Supported Collaborative Learning Conference 2005, IEEE International Conference on Advanced Learning Technologies 2005, and International Conference on Intelligent Tutoring Systems 2006. Taiwan also cooperated with the Advanced Distributed Learning Co-Laboratory (ADL Co-Lab) hosted International Plugfest II and held the 2006 International Conference on SCORM 2004 in conjunction with International Plugfest II.

Beside the international academic activities, Latchem (2006), the editor of British Journal of Educational Technology, did a quantitative survey on the publications in the past five years. The results showed that Taiwan was ranked the 4th for the publications from 2000 to 2005 in the Journal.

The national program also investigated in academic publication status in Taiwan in the following six SSCI journals. The data was queried from database in ISI Web of Science, from Jan. 2001 to Sep. 2006. The six journals are:

- Computers & Education (C&E)
- Journal of Computer Assisted Learning (JCAL)
- Educational Technology & Society (ET&S)
- ETR&D-Educational Technology Research and Development (ETR&D)
- Innovations in Education and Teaching International (IETI)
- British Journal of Educational Technology (BJET)

Table 12: Paper publication amounts (from ISI Web of Science, 2000.1.1 to 2007.12.17, ranked by country)

Journal name	No.1	No.2	No.3	No.4	No.5
C&E	England(115)	USA(86)	**Taiwan(52)**	Australia(27)	Netherlands(21) Spain(21)
JCAL	England(99)	**Taiwan(52)**	USA(30)	Netherlands(21)	Australia(17) China(17)
ET&S	USA(75)	England(30)	**Taiwan(27)**	Greece(24)	Canada(22)
ETR&D*	USA(176)	Netherlands(21)	Canada(8)	Australia(7)	South Korea(7)
IETI	England(101)	Australia(20)	**Taiwan(16)**	Scotland(12)	USA(12)
BJET+	England(207)	USA(83)	Australia(70)	Scotland(53)	India(34)
Total	**England(553)**	**USA(462)**	**Taiwan(178)**	**Australia(158)**	**Netherlands(121)**

*Taiwan has one paper, No. 13
+Taiwan has 30 papers, No. 7

Table 13: Paper citation amounts (from ISI Web of Science, 2000.1.1 to 2007.12.17, ranked by country)

Journal name	No.1	No.2	No.3	No.4	No.5
C&E	USA(86) 187 times	England(115) 144 times	**Taiwan(52)** **123 times**	Netherlands(21) 88 times	Spain(21) 38 times
JCAL	England(99) 164 times	**Taiwan(52)** **135 times**	USA(30) 62 times	Netherlands(21) 40 times	Australia(17) 38 times
ET&S	Netherlands(20) 39 times	England(30) 28 times	Greece(24) 26 times	USA(75) 21 times	**Taiwan(27)** **15 times**
ETR&D*	USA(176) 381 times	Netherlands(21) 72 times	Australia(7) 34 times	South Korea(7) 17 times	England(1) 7 times
IETI	England(101) 44 times	**Taiwan(16)** **24 times**	Australia(20) 9 times	Scotland(12) 6 times	USA(12) 5 times
BJET	England(207) 225 times	USA(83) 73 times	Australia(70) 50 times	**Taiwan(30)** **48 times**	Netherlands(33) 46 times
Total	USA(462) 729 times	England(553) 652 times	**Taiwan(178)** **345 times**	Netherlands(121) 285 times	Australia(158) 147 times

*Taiwan's one paper has not been cited yet

Table 14: numbers of academic research papers in Taiwan in the six journals (from 2000.1.1 to 2007.12.17)

	2000	2001	2002	2003	2004	2005	2006	2007	sum
BJET	1	4	4	2	1	5	6	8	31
C&E	3	7	3	4	6	7	8	17	55
ET&S	0	0	0	1	2	6	10	8	27
ETR&D	1	0	0	1	0	0	0	0	2
IETI	0	0	2	4	2	3	3	2	16

JCAL	0	8	8	11	9	6	4	6	52
Total	5	19	17	23	20	27	31	41	183

From Table 14, the academic papers published in the six journals have increased gradually. Although publication number has increased, the researches mainly focus on the system development and are limited to the laboratory and/or specific experimental environment. Therefore, the national program should focus on the learning environment and exam designs in practicality, encourage the long term research plans, create more opportunities for testing new systems in real environment, and encourage the cooperative research projects cross different domains or countries.

Conclusions

Taiwan government has set up a five-year national program for e-learning since 2003. Benefit that the industries have gained from the national program is obvious. And as showed in Figure 1, the e-learning market keeps growing amazingly. The national program not only benefits industries but also the public. As we can see that 36,187 e-learning courses have had been developed and attracted over eighteen millions visiting counts listed on Table 3. Meanwhile, two cases have proved how the national program can affect the public. Furthermore, the IDB of MOEA and the National Science Council have developed advanced learning technologies; brought researchers and enterprises into cooperation; turned research results into products and patent applicable; and transfer new technologies and innovations to e-learning vendors in order to increase their competitiveness and quality of e-learning products.

Some bottlenecks were encountered in the past five years, including the collaboration issues between different participant agencies and divisions each agency holds. For examples, CLA may want to emphasize on how e-learning supports employee to update working knowledge and unemployed people to have required working skills in order to get jobs; NPM may want to focus on how e-learning attracts visitors and teaching them knowledge of Chinese culture; and, MOEA may want to know how e-learning can help improve commercial competitiveness. Healthy collaboration among agencies is a huge issue for the national program. Taiwan government demands different participating agencies to work together and/or support each other. For example, CLA and MOEA construct some e-learning courses training the unemployed and delivering working knowledge, furthermore, MOE, CLA, and MOEA work together to build a certificate for technicians and designers of e-learning, the technicians and designers can then get into businesses and help the businesses apply e-learning into the organizations.

From 2008 to 2012, Taiwan government has set up another program for e-learning, Taiwan e-Learning and Digital Archives Program (TELDAP). The new program includes eight projects: Taiwan Digital Archives Expansion Project, Research and Development of Digital Archive and e-Learning Technologies Project, Core Platforms for Digital Contents Project, The Project of Academic and Social Promotion and Applications for Digital Archives and e-Learning Project, Industrial Development and Promotion of Digital Archives and e-Learning Project, ICT in Education and e-Learning Project, Chinese Language e-Learning Project, International Collaboration and Promotion of Taiwan Digital Archives and e-Learning Project. National Program for e-Learning works with National Digital Archives Program to popularize the knowledge in the archive; head to a knowledgeable society; nourish e-learning industries and develop Chinese e-learning system in practical aspect; deepen the influence both on formal education and lifelong learning; and create sustaining benefit as improving national competitiveness.

We expect Digital Archive and National Digital Archives Program to expand its influence on national human resources and art development; enable the ample of Taiwanese culture establish its subject position, entering the era of globalization and knowledgeable society synchronously with the developed countries in American and Europe; by digital learning, to develop national population quality and cultivate talents and establish digital learning industry, providing digital teaching services and products to the world.

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