HIGHER EDUCATION PROMOTION FOR KNOWLEDGE-BASED ECONOMY : A COMPARATIVE STUDY OF BRAIN KOREA 21 AND THAILAND'S NATIONAL RESEARCH UNIVERSITIES

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นางสาวแก้วตา สมานจิตต์

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การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาทิศทางการพัฒนาการศึกษาโดยการส่งเสริมการวิจัยในระดับอุดมศึกษาของประเทศเกาหลีและเปรียบเทียบโครงการ Brain Korea 21 ซึ่งเป็นกลยุทธ์สำคัญในการพัฒนาการศึกษาระดับอุดมศึกษาสู่เศรษฐกิจองค์ความรู้กับโครงการมหาวิทยาลัยวิจัยแห่งชาติของประเทศไทยเพื่อเสนอนโยบายในการพัฒนาสถาบันอุดมศึกษาของไทยต่อไป งานวิจัยนี้ได้ใช้วิธีการวิจัยเอกสารและการสัมภาษณ์ผู้ให้ข้อมูลทั้งจากประเทศเกาหลีและประเทศไทย ผลจากการศึกษาพบว่า โครงการ Brain Korea 21 เป็นตัวอย่างกลยุทธ์ของรัฐบาลในการส่งเสริมมหาวิทยาลัยวิจัยเพื่อให้ตรงกับความต้องการด้านทรัพยากรมนุษย์ระดับสูงโดยให้เงินสนับสนุนแก่นักศึกษาในระดับปริญญาโท ปริญญาเอกและนักวิจัยที่ได้รับคัดเลือกให้เข้าร่วมโครงการซึ่งกระตุ้นให้เกิดการแข่งขันเพื่อพัฒนาศักยภาพของมหาวิทยาลัยและการพัฒนาความเป็นเลิศของทรัพยากรบุคคล ขณะที่โครงการมหาวิทยาลัยวิจัยแห่งชาติของไทยแสดงให้เห็นถึงความพยายามในการส่งเสริมมหาวิทยาลัยวิจัยให้มีขีดความสามารถระดับโลก อย่างไรก็ตามโครงการมหาวิทยาลัยวิจัยแห่งชาติยังอยู่ในระยะเริ่มต้นเท่านั้นและยังประสบปัญหาด้านความล่าช้าของงบประมาณและระบบบริหารจัดการที่แตกต่างกันของมหาวิทยาลัยที่ร่วมโครงการ ดังนั้นจึงต้องอาศัยการดำเนินการอย่างจริงจังและต่อเนื่องจึงจะสามารถพัฒนาประเทศไทยให้เป็นศูนย์กลางการพัฒนาด้านการวิจัยในระดับภูมิภาคและเพิ่มความสามารถในการแข่งขันระดับนานาชาติได้

สาขาวิชา เกาหลีศึกษา ลายมือชื่อนิสิต……

ปีการศึกษา 2554 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก……..

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KEYWORDS : HIGHER EDUCATION / KNOWLEDGE-BASED ECONOMY/ BRAIN KOREA 21 / THAILAND'S NATIONAL RESEARCH UNIVERSITIES

KAEWTA SAMANJIT : HIGHER EDUCATION PROMOTION FOR KNOWLEDGE-BASED ECONOMY : A COMPARATIVE STUDY OF BRAIN KOREA 21 AND THAILAND'S NATIONAL RESEARCH UNIVERSITIES. ADVISOR : PITI SRISANGNAM, Ph.D., 109 pp.

The purpose of this research was to study Korea's direction of education development through nurturing research in higher education institutions and compare Brain Korea 21 Project, which one of the major higher education development strategies to lead Korea toward knowledge-based economy, with Thailand's National Research Universities Project to improve the policies for the development of Thailand's higher education institutions. The researches employed documentary research and interviewed the informants of education in South Korea and Thailand. The results showed that Brain Korea 21 Project is an example of Korea's government strategies to nurture research universities to meet the demand of high quality human resources by providing stipends and scholarships to Master and Doctoral students and researchers, who were selected to participate in the project to stimulate competitiveness. It also greatly improved development of excellence human resources and, in turn enhance the capacities of universities, while Thailand's National Research Universities Project represents an effort to promote World-Class University Research. However, the National Research Universities Project is still in early stage and needs some solutions for delay budget and different administration systems of participated universities. Thus, candidness and consistency are necessary to develop Thailand to be regional education hub and enhance internationally competitiveness.

Field of Study : KOREAN STUDIES Student's Signature .....

Academic Year : 2011 Advisor's Signature .....

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CHAPTER I
INTRODUCTION

1. Research Background.

At the beginning of 21st century, the term "globalization" is widely used in various sections, including politics, economics, cultures, and education. It refers to the development of increasingly integrated systems and relation beyond the nations.[1] Globalization is described as a complex process of creating worldwide network of capital technology and information made possible through enhanced competition, stronger interconnection and greater independence. Two of the main bases of globalization are information and innovation, and they, in turn, are highly knowledge intensive.[2]

While the global economic competition grows sharper, nations will distinctly need to have a competitive advantage in at least some of the major industrial sectors, such as telecommunications, electronics, chemicals and automobiles. It can be said that nation which has advanced information and communication infrastructure has more advantages competitiveness in economy. Many countries are increasingly based on knowledge and information and knowledge is become the factor that drives productivity and economic growth. The term "knowledge-based economy" results from a fuller recognition of the role of knowledge and technology in economic growth[3]. Thus compared to the past, enterprises will need to update their employees' skills to respond to the opportunities or threats created by globalization and rapid technological change. Indeed intense global competition is reconfiguring the market place. Enterprises increasingly have to compete by differentiating themselves from their competitors by the quality of the human systems and processes behind its

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[1] Jeong Kyu, Lee. Globalization and Higher Education: A South Korea Perspective. [Online]. 2004. Available from http://www.eric.ed.gov/PDFS/ED490410.pdf [2010, 1 Febuary]

[2] Martin Carnoy. Globalization, Education Trends and Open Society. Education and Open Society: A Critical Look at New Perspectives and Demands. 2005:3.

[3] OECD. The Knowledge-Based Economy. Paris: OECD, 1996.

products and services[4]. The international movement of human capital comprises the movement of scientists, engineers (e.g. in the information sector), executives, and other professionals across frontier. These are people with special talents, high skills, and specialized knowledge in the scientific, technological and cultural area.

Education is central to development. It represents an investment in knowledge and skills that increase human ability to earn. In developing country, education is also linked to the whole batch of indicators of human development. Investment in education benefits the individuals, the nation and the world. For individuals, education increases productivity and earning as well as reducing inequality. For society, education drives economic competitiveness. An educated and skilled workforce is one of the pillars of the knowledge-based economy. Particularly, nations come less from natural resources or cheap labor. It could be said that, education is one of the main key factors to improve human skill and ability for that advantage especially, higher education is very needed.

Higher education prepares a quality workforce by offering instructional programs, matching instruction to the needs of business and industry and helping individual learns throughout their life.[5] It can help employees to be proficient in language, mathematics, and science. Employees who received higher education can read and understand blueprints and operational manual for complex and expensive machines and instruments. Higher education also increases employees' literacy and numeracy skill in order to master the complex and sophisticated skill of modern trade and technical occupations.

South Korea (Korea hereafter) has achieved one of the fastest rates of economic development of any country in the world. Between 1966 and 1996, its per capita income grew by an average of 6.8% by annum. However, Korea experienced its worst economic crisis in 1997. Nonetheless, Korea made a remarkable recovery from the crisis at 10.7% in 1999. After the crisis, Korea is expected to face a much more difficult and competitive global environment from its rising wage and increasing

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[4] Ibid.

[5] NIU Outreach. The Role of Higher Education in Economic Development. Higher Education Alliance for the Rock River Region. 2005: 5.

competition from lower wage countries in East Asia. Increasing scientific understanding and vary rapid advances in information and communication technologies (ICTs) are making knowledge and information one of the most important factors for competitiveness.[6] In consequence of these developments and global knowledge revolution, Korea is facing the new challenge of transforming itself into a knowledge-based economy. As seen in figure 1, the high-technology exports inclines to rise continuously.

Figure 1: High Technology Exports (% of Manufactured Exported)

1988 15.82	1992 19.59	1996 23.86	2000 34.82	2004 32.76
1989 17.63	1993 20.09	1997 26.37	2001 29.55	2005 32.33
1990 17.84	1994 22.51	1998 26.82	2002 31.3	2006 32.01
1991 19.18	1995 25.87	1999 31.92	2003 32.15	2007 33.45

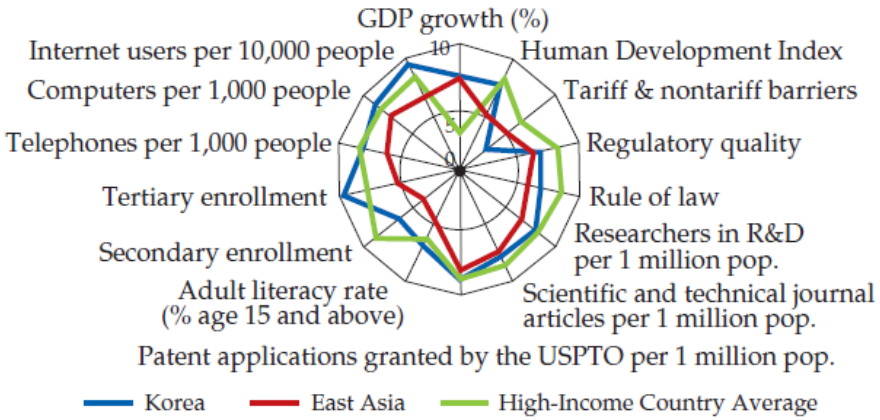
Source: Trading Economics (http://www.tradingeconomics.com)

The World Bank's Knowledge Assessment Methodology (KAM) Basic Scorecard, which benchmarks countries' overall readiness to use knowledge for economic development, shows that Korea has evolved into a relatively mature knowledge- based economy, performing well above the average country in East Asia and on par with average high-income countries as indicated in figure 2.[7]

[6] World Bank. Republic of Korea Transition to Knowledge-Based Economy. 2000: i.

[7] World Bank. Korea as a Knowledge Economy: Evolutionary Process and Lessons Learned, 2007:8.

Figure 2: KAM Basic Scoredcard for Korea, East Asia and High-Income Country Average



Source: The World Bank: Korea as a Knowledge Economy: Evolutionary Process and Lessons Learned, p8.

Education plays a key role on human resource development for Korea. One of the main strengths of Korea's education system is high investment in education. Korea's educational development phase can be divided into four phases in accordance with economic development and social strategy. The first phase between independence and reconstruction after the Korean War from 1945 to 1960 was the period of building a basic education system. This time included the establishment of education laws and school systems. The human capital formation and socialization through basic public education to provide abundant low income labour force also were preceded.

The second phase begun from the 1960s to 1970s, a rapid rise in industrial demand for low-skilled and semi-skilled human resources to support state-driven and exported-orient industrialization was sharply pursued and led to the quantitative expansion of secondary education. From 1972, with the implementation of Five-Year Economic Development Plans (was renamed the "Five Year Economic and Social Development Plan" in 1982), a state-led human capital formation system was built in order to forecast the demand for industrial human resources and supply them at the right time.

There was a period of expansion of higher education in the third phase from 1980s to the early 1990s. Since the democratization movement in 1987, reformist labor union activities increase, the role of civil organization expanded, and the influence of industries rapidly grew. As a result, the social demand for reforms in state-driven human capital formation increased.

There was a movement towards the universalization of higher education and expansion of lifelong learning in the fourth phase from the mid-1990s to present. The development state model according to state-led economic development plans ended and the transition to an innovation-led human capital formation system fully unfolded with the establishment of the World Trade Organization (WTO) system, the 1997-8 Asian financial crisis, expansion of global market economy, informatization, and the development of knowledge-base economy. Thus, the enhancement of the competitiveness of higher education and building a system of lifelong learning were essential.

The role of education in a process of human capital has been increased as domestic and global interest. Higher education was innovated to increase endeavors to specialize in areas of strength and operate under a highly competitive environment. From 1945 to 2008, higher education was vigorously expanded in order to support human resource as a part of several national economic development plans as indicated in table 1.

Table 1: Growth of Higher Education

Year	Number of Schools	Number of Students	Number of Professors
1945	19	7,819	1,490
1950	55	11,358	1,100
1955	74	84,996	2,626
1960	80	81,519	4,027

Year	Number of Schools	Number of Students	Number of Professors
1965	157	142,629	5,351
1970	168	201,436	10,270
1975	205	318,683	13,819
1980	237	647,505	20,662
1985	262	1,451,297	33,483
1990	265	1,691,681	42,911
1995	327	2,343,894	58,977
2000	372	3,363,549	57,632
2005	419	3,548,728	66,862
2008	405	3,562,844	73,072

Source: Kim Young-Chul. Universalisationof Tertiary Education, p 13-14.

Korea's higher institutions have produced talented people in the fields of politics, economics, society, science, culture, and art as indicates in figure 3 and 4.

Figure 3: A Number of Students in Colleges and Universities by Field of Studies

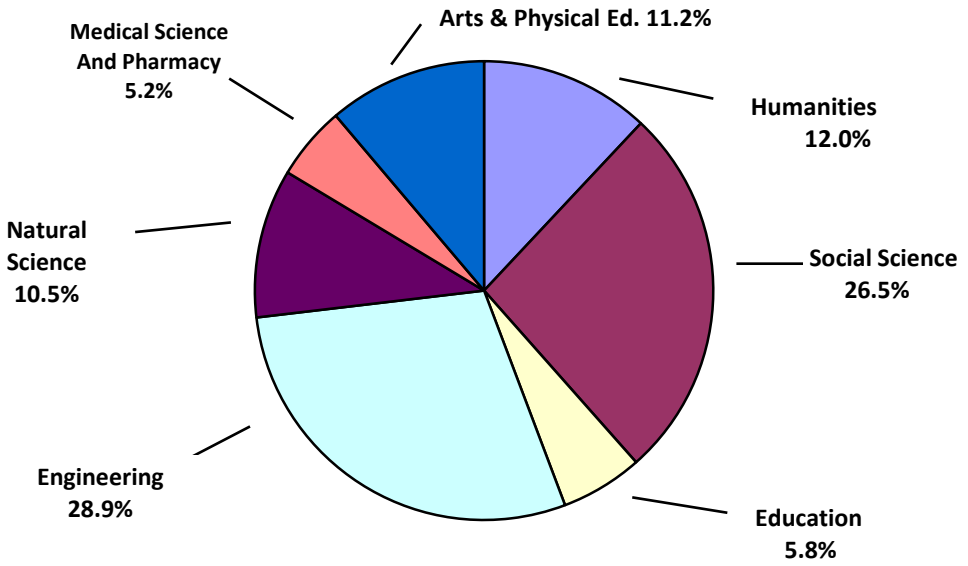
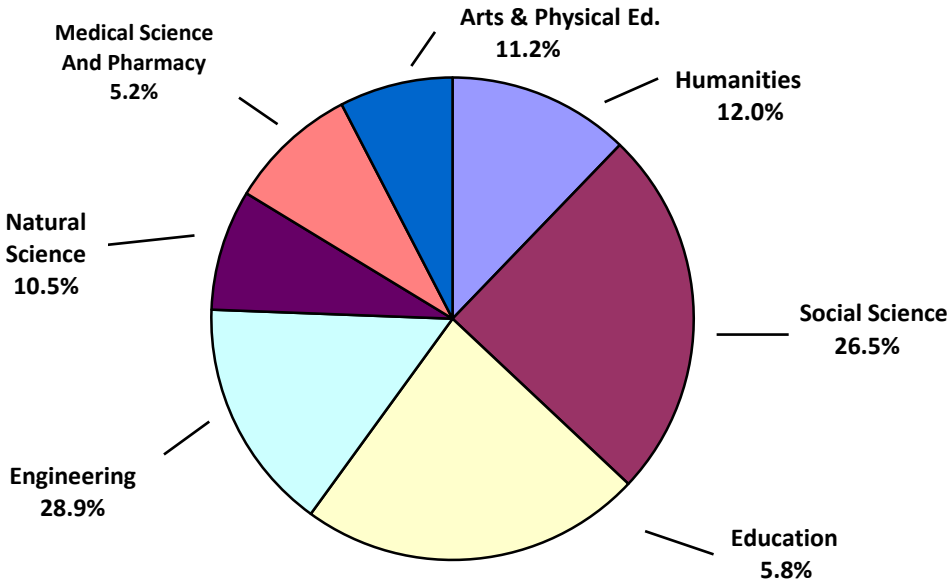


Figure 4: A Number of Students in Graduate Schools by Field of Studies



Source: Ministry of Education & Human Resource Development. Korean Educational Development Institute. Brief Statistic of Korean Education, p. 50.

Quantitatively, the number of graduates of tertiary educational institutions increased dramatically from 33 thousand in 1970 to 570 thousand in 2007. The number of graduates of both junior colleges and graduate schools has increased rapidly.[8] These people have become major human resources and help to stimulate national development as indicated in table 2 and figure 5.

Table 2: Graduates of Higher Education Institutions

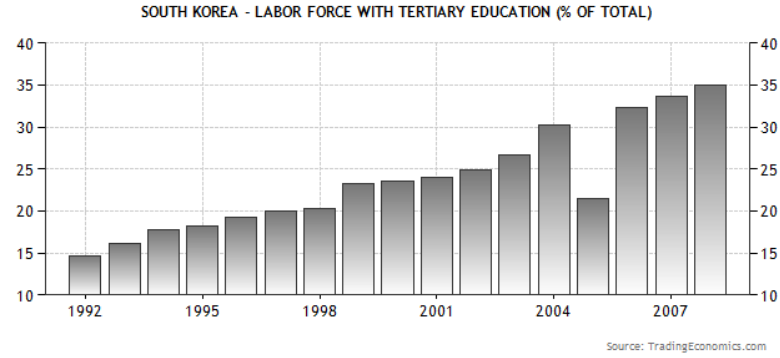
(**Unit: Person**)

Year	Total	Junior Colleges	Universities	Graduates
1970	33,503	7,838	23,515	2,150
1975	51,182	14,106	33,610	3,466
1980	106,794	51,507	49,735	5,552
1985	210,548	73,927	118,584	18,037
1990	275,316	87,131	165,916	22,269
1995	355,244	143,075	180,644	31,505
2000	403,577	175,965	192,465	35,147
2005	542,196	223,489	214,498	53,379
2008	572,704	207,741	282,670	82,293

Source: Kim Young-Chul. Universalisation of Tertiary Education, p 18.

[8] Kim, Young-Chul. Understanding Korean Educational Policy. Universalisation of Tertiary Education. Seoul: Gyeong Seong Printing. 2008: 18.

Figure 5: South Korea Labor Force with Tertiary Education (% in total)



1991 14.6	1995 19.2	1999 23.5	2002 26.7	2005 32.3
1992 16.2	1996 20	2000 24	2003 30.3	2006 33.7
1993 17.8	1997 20.3	2001 24.9	2004 21.5	2007 35
1994 18.2	1998 23.2			

Source: Trading Economics (http://www.tradingeconomics.com)

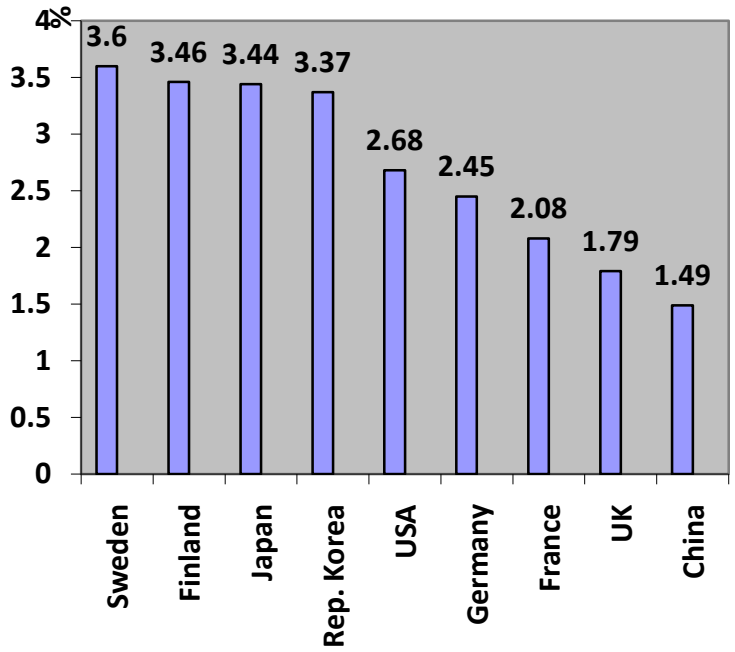
Korea has also achieved the outstanding research progress in R&D. Korea ranked 12th in the number of papers published in SCI-level journals among 180 countries in 2007, one notch up from a year earlier. A total of 25,494 Korean papers were posted on the Science Citation Index (SCI) of the National Science Indicator database, accounting for 2.17 percent of all journals released around the world, achieving nearly double that of 1998 (1.13 percent). The United States topped the ranking with 293,371 papers, followed by the U.K, China, Germany and Japan. The sum of journals from these five countries (596,544 papers) accounts for 50.66 percent of the journals worldwide (1,177,528 papers). Korea and China showed the highest growth rate as compared to 2007, marking a 9.43 and 14.34 percent increase, respectively. Korea displayed marked achievements in the fields of material science (5th rank), computer science (7th rank), pharmacology (7th rank), physics (8th rank) and engineering (10th). Korea's SCI journal entries were cited 3.44 times per journal over the five-year period of 2003 to 2007, up from 3.27 times in the preceding period of 2002 to 2006. [9]

[9] Ministry of Educationa, Science and Technology. Korea ranks 12th in the Number of SCI-Level Papers in 2007 [Online]. 2008. Available from: http://english.mest.go.kr/web/1759/en/board/enview.do?bbsId=265&pageSize=20&currentPage=11&boardSeq=1316&mode=view [2011, April 13].

In Korea, investment in education, information infrastructure and research development (R&D) as a percentage of GDP are among the highest in OECD countries.[10] Government investment in R&D has increased steadily since 2003. The government share of the annual budget dedicated to R&D reached a total KRW 42.4 trillion (US$ 31.9 billion) or some KRW 10 trillion (US$ 7.5 billion). From 2005-2009 total government in R&D increased by 12.2%, a consider higher rate than the increase in total government expenditure of about 8.0%.[11]

Figure 6: International Comparison of R&D Intensity

in the Republic of Korea 2008



Source: Lee Jang Jae. UNESCO Science Report, 2010: the Current Status of Science Around the World, p 419.

Korea government realized the crucial of creativity, which leads to the foundation of innovation and will be necessary for global competition. As a result, major policies to support the development of basic science and human resources have

10 Ibid.

11 Lee Jang Jae. UNESCO Science Report, 2010: the Current Status of Science around the World. Paris: United Nation Educational, Scientific and Cultural Organization, 2010: 19.

formulated and implements. Higher education plays the important role in creating and maintaining highly skilled labour forces. Thus, Korea has been trying to build a world- class higher education.

The Brain Korea 21 (BK 21) initiated in 1999-2005 was one of a major higher education reform projects that aimed at cultivating creative and high quality human resources necessary for the 21st century. For this project, the government invested 200 billion won per year (1.34 trillion won in total). The Natural and Applied Science and Technology and Humanities and Social Science were two subject areas supported by the project. The Natural and Applied Science and Technology include the field of Information Technology, Physics, Chemistry, Mechanics and Materials, Biotechnology, Material Engineering, and others. The Humanities and Social Science area includes History, Language, Philosophy, Education, Law, Administration, Politics, Economic, Psychology and so on. For the former area, the annual financial support for each team project ranges from 800,000 dollars to 6 million dollars and from 150,000 to 750,000 dollar for the latter area.

Brain Korea 21 succeeded in enhance research capacities of participating graduate students by increasing number of papers listed on SCI in Science and Technology area and papers published in nationwide journals in Humanities and Social Science area as can be seen from figure 7 and 8.

Figure 7: Number of Papers Listed on SCI

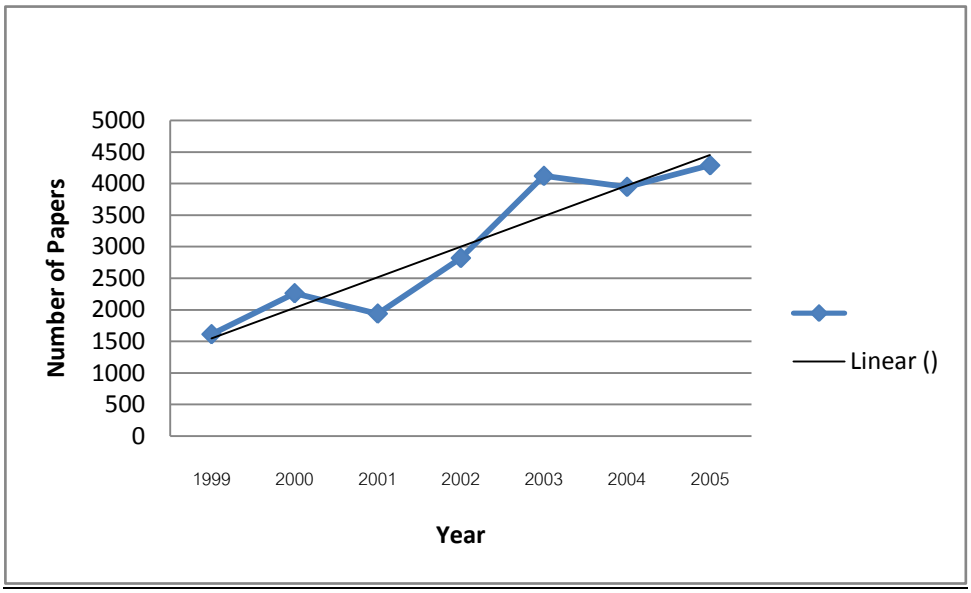
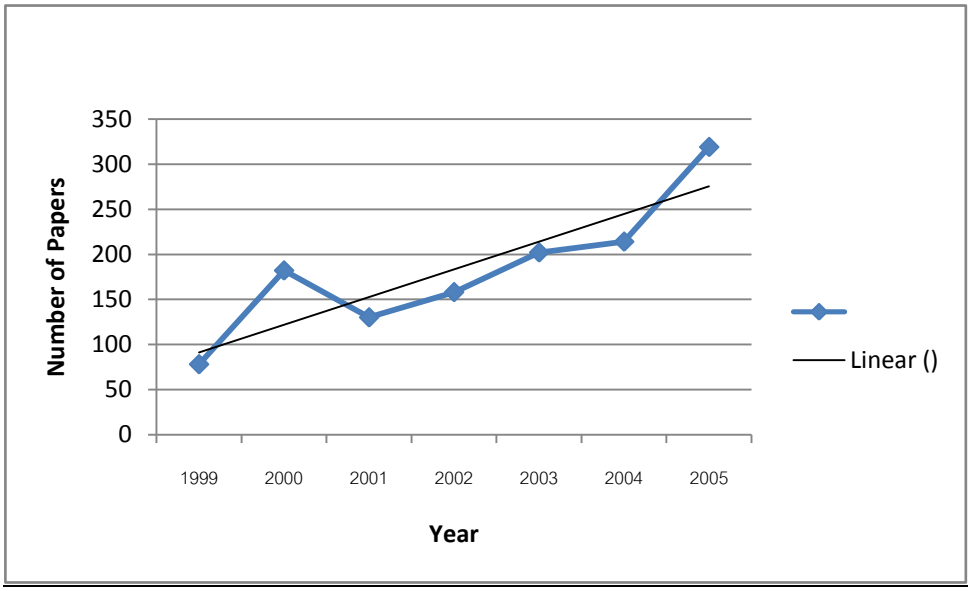


Figure 8: Number of Papers Published in Nationwide Journals



Source: BK 21 and NURI Committee (http://bnc.krf.or.kr/home/eng/index.jsp)

Furthermore, the number of international and domestic patents in Applied Science and Technology and Specialized areas also increased through the project as indicated in table 3.

Table 3: Increases in Achieving International and Domestic Patents (Applied Science and Technology and Specialized areas)

Patents	Number of Acquired Patents	
	Before	After
International	116.6	160
Domestic	29	41

Source: Mugyeong Moon and Ki-Seok Kim. A Case of Korean Higher Education Reform: The Brain Korea 21 Project, p. 103.

Owing to the success of Brain Korea 21 Phase I, Korea government initiated Phase II in 2006 and will run through 2012 and invested 290 billion won per year (2.03 trillion won in total). In term of missions and goals, selection criteria, and rules of funding, the Phase I and Phase II are not much different. Subtle and nuanced in emphasis are the few differences between the two phases. Phase I emphasized

university-level excellence whereas Phase II focuses on the university industry link more than Phase I does. Reforms of institution are emphasized in Phase I more than in Phase II. Department of a single university is a base of Phase II research group, whereas Phase I research groups initially started with investigators from many universities which is a topnotch university and participating universities in the same academic discipline.[12]

Globalization influenced on higher education in Thailand as well. The production of high skilled labour is very needed for international competitiveness. However, Thailand has low proportion of scientists and engineers per capita and national innovation capacity still lagged behind East Asian counterparts.

In 2005, Thailand allocated only 0.7% of GDP to higher education which far below Korea as indicated in table 4.

Table 4: Public Expenditure on Higher Education

Countries	% of GDP
China	0.8
Denmark	2.7
Germany	1.2
India	0.7
Ireland	1.2
Malaysia	2.7
OECD Average	1.3
Philipines	0.7
South Korea	**2.4**
Sweden	2.2
Thailand	**0.7**
United Kingdom	1.1

[12] Somi Song, Steven W. Popper, Charles A. Goldman and David K.Evans. Brain Korea 21 Phase II: A New Evaluation Model. Pittsburgs: RAND Corporation, 2008.

USA	1.4
Finland	1.7

Source: World Bank. Towards a Competitive Higher Education System in a Global Economy, p 69.

Furthermore, It could be observed that Malaysia allocate to higher education more than Thailand, which is in the same region, because Malaysia has been in the process of transforming its economy from one based on mass production and relatively unskilled labor to one based on knowledge and creativity. In implementing this change, the state has allocated 8 percent of total governmental expenditure or (RM 11.3 billion) to higher education[13].

Based upon this analysis, Thai government foresees that important of improving higher education quality and, has proposed a National Research University project which run through. 2010 to 2012, and invests 12,012 million baht for this project. The project aims to prepare world class university with the idea of becoming education hub within the ASEAN region Thus, studying on Korea's strong human resource development and R&D nurtured by higher education institutions is useful for Thailand.

2. Research Problems

The reason why writing this research, that is because Korea government uses education, particularly higher education, as an important instrument for human resource development and, make Korea become economic success nation. In the early years of knowledge-based economy and society, Korea foresees the role of higher education as a crucial factor that determine the competitiveness and growth of individuals and nation by funding higher education institutions. The Brain Korea 21 project, which aims at fostering world-class graduate school and high quality scholars,

13 Higher Education Finance and Cost-Sharing in Malaysia [Online]. 2009. Available from http://gse.buffalo.edu/org/inthigheredfinance/files/Country_Profiles/Asia/Malaysia.pdf [2010, April 13]

was initiated to prepare Korean human resource development for the 21st century. Meanwhile, Thai government also realizes the important of strengthening the university's capacity to do research and produce advanced knowledge and establish National Research University project to support research in higher education level. Thus, studying on Korea's strong human resource development and R&D nurtured by higher education institutions are necessary to be guideline for Thailand.

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3. Research Objectives

3.1 To study Korea's direction of human resource development by nurturing higher education.

3.2 To study Brain Korea 21 project which one of the major higher education development strategies, which lead Korea to knowledge-based economy.

3.3 To compare Brain Korea 21 project with National Research Universities to find policy for Thailand's higher education institutions development.

4. Research Benefits

4.1 Be able to understand Korea's direction of human resource development by nurturing higher education.

4.2 Be able to understand Brain Korea 21 project's advantages to strengthen higher education capacity for knowledge-based economy.

4.3 Be able to find policy for Thailand's higher education institutions development.

5. Research Scope

This research focuses on Korea's direction of human resource development by nurturing higher education in 1999 to 2012 since Brain Korea 21 project was initiated and run through this period. The research also focuses on higher education promotion in Thailand between 2010 to 2012 because National Research University Project was initiated and run through this period.

6. Research Methodology

This study employed descriptive research by using documentary and interviews. Documentary research was based on documents from related government

agencies in both Korea and Thailand, and particular the Ministry of Education, BK21-NURI Committee, and National Research Universities, which was collected by internet and secondary data collected from books, academic journals, articles in magazines and related research. For interviews, I interviewed informants who expert in the field of education of Korea. Subsequently, interviews were conducted with Thai's informants and the results were analyzed to find appropriated policies for Thailand's higher education institutions development.

7. Definition of Terms

7.1 Knowledge-based economy means economies which are directly based on the production, distribution and use of knowledge and information.[14]

7.2 Globalization means the process by which businesses or other organizations develop international influence or start operating on an international scale.[15]

7.3 Higher education means education at a university or at a college of a similar level.[16]

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[14] OECD. The Knowledge-Based Economy. Paris: OECD, 1996.

[15] Jukka Takala and Päivihämäläinen. Globalization of Risks. [Online]. 2009. Available from: http://osha.europa.eu/en/press/articles/globalization-of-risks [2010, April 13]

[16] Michael Mayor et al. Mcmillan English Dictionary. Malaysia: Boomsbury Publishing Plc, 2002.

CHAPTER II
LITERATURE REVIEWS

This study focused on the higher education for knowledge-based economy in South Korea. To understand this complexity, I reviewed the different approaches to the studies. The approaches are as followed:

2.1 Concept of human capital and education

2.2 Concept of knowledge-based economy

2.3 Related Researches

2.1 Concept of human capital and education

There were many researchers state the relationship between human capital and education as follows;

Olaniyan D.A and Okemakinde described education is both consumer and capital good. As capital good, education can be used to develop the human resource necessary for economic and social transformation by creating improved citizens and helping to upgrade the general standard of living in a society. [1]

Diego Lanzi mentioned education creates human capital and increases individual skills, abilities and competencies. Human capital accumulation affects individuals' well being directly and indirectly. In direct way, it increases human qualities and skills for economic production (re-production) and market exchange. In indirect way, it enlarges individuals' opportunity to improve their lives. [2]

Timothy Schiller asserted education is an investment in human capital, and produce a return to the individual and social. The important of education to economy has been growing. Even as the number of colleges in the labour force has increased,

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[1] Olaniya. DA and Okemakinde. Human Capital Theory: Implications for Educational Development. [Online]. 2004. Available from: http://www.eurojournals.com/ejsr_24_2_01.pdf [2010, Febuary 4]

[2] Diego Lanzi. Capabilities, Human Capital and Education. [Online]. 2004. Available from: http://www-3.unipv.it/deontica/ca2004/papers/lanzi.pdf [2010, Febuary 4]

the wage gap between these workers and those with less education has widened. The increased wage reflects an increase in demand that has been greater than the increase with the education and skills to use them and more of nation's economic growth has been originating in sectors with high demand for skilled workers. The investment in new technology could reflect firms' desire to take advantage of the increase in the supply of college-educate workers or it could be a result of the development of new general purpose technologies, such as advances in computers and telecommunications, that either require or are most productively used by educated workers.[3]

Brian Noland mentioned education investment gives direct benefits to individuals and society. Education is one of the variables that drive micro and macro level prosperity from increased earning capacity to worker productivity. [4]

Catalin Churiac described knowledge has become the first element of human development in general and of the economic one. Developed countries evolve rapidly on the coordinates of the postindustrial economies which can be understood as knowledge economies. The true source of power is knowledge and information because they amplify, multiply and diversify through their consumption. Unlike other resources, knowledge is infinitely expandable, representing a virtually limitless resource for economic development. Therefore, educations play an important role on economic growth and become essential tool to sustain development. Without good education, economic development is impossible especially developing courtiers with low human capital, a huge boost to economic sustainable growth can only achieve through large investment in education and the adoption of new technologies which require more specialized work or educate people.[5]

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[3] Thimothy Schiller. Human Capital and Higher Education: How does Our Region Fare?. [Online]. 2008. Available from: http://www.philadelphiafed.org/researchanddata/publications/ businessreview/2008/q1/schiller_human-capital-and-higher-education.pdf [2011, April 17]

[4] Brian Noland**.** Current Issues in Tennessee Higher Eduction in Public Policy. Nashville : 1998.

[5] Catalin Churiac. Human Capital and Education for Sustainable Development in a Global World. CES Working Papers : 4 : 16-17.

Katsuya Taki and Ryuichi Tanaka asserted the diversity of human capital induced by income inequality always lower the GDP of the next period, while the diversity of human capital induced by heterogeneous ability can increase GDP, if the produced intermediate goods are sufficiently substitutable and firms have a large span of control. Hence, as public education equalizes education across households, it lessen the negative effect of income inequality of GDP, while the effects of ability tracking crucially depend on the production structure of the economy.[6]

Baiju K.C. described human capital is the end product of human resource development. Education is an instrument in building human capital, fostering skill, knowledge and competence leading to human resource development and economic growth. In the era of globalization, knowledge has been termed as power, not only in terms of strength but, in term of decisive factor controlling economic and productive sectors. Currently, there has been a close association between the economic performance and applicability of ideas gather through education.[7]

Schultz mentioned although education is in some measure a consumption activity rendering satisfactions to the person at the time he obtains an education, it is predominantly an investment activity undertaken for the propose of acquiring capabilities that render future satisfactions or that enhance future earning of the person as a productive agent. Thus a part of it is a consumer good akin to conventional consumer durables, and another part of it is a producer good. Therefore, education is human capital since it's a part of person receiving it.[8]

In conclusion, knowledge and skills of individuals can be accumulated through education and education is an investment in human capital. It helps to increase human qualities and skills which are necessary for economic production.

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[6] Katsuya Taki and Ryuichi Tanaka. Does the Diversity of Human Capital Increase GDP. [Online]. 2006 Available from: http://www.soc.titech.ac.jp/~library/discuss/text/dp06-05.pdf [2010, 3 July]

[7] Baiju, K.C. Revamping Higher Education in The Context of Knowledge Economy: A Road Towards Pro-Active Human Development. [Online]. 2009. Available from: http://www.napsipag.org/PDF/BAIJU-%20HUMAN-CAPITAL.pdf [2010, 3 July]

[8] Schultz, T.W. Investment in Human Capital. American Economic Review. 51: 1- 17.

Therefore, a high level of human capital leads to a high level of individuals and nation.

2.2 Concept of knowledge-based economy

OECD described knowledge-base economy results from a fuller appreciation of the role of knowledge and technology in economic growth. Knowledge, as embodies in human beings as human capital and in technology, has always been central to economic development. The investments in research and development, education and training and new managerial work structures are very important. Economic performance depends on knowledge distribution through formal and informal networks. Employment in the knowledge-based economy is characterized by increasing demand for more highly-skilled worker. Changes in technology and particularly the advent of information technologies are making educated and skilled labour more valuable and unskilled labour less so. Government policies will need more significance on upgrading human capital through promoting access to a range of skills, and especially the capacity to learn; enhancing the knowledge distribution power of the economy through collaborative networks and the diffusion of technology; and providing the enabling conditions for organizational change at the firm level to maximize the benefits of technology for productivity. Public research laboratories and institutes of higher education, carries out key functions in the knowledge-based economy as well, including knowledge production, transmission and transfer.[9]

According to Asian Development Bank, knowledge-based economy composed of four-pillar;

1. Education and skilled workforce: the workforce must posses competencies including creativeness, responsiveness, productiveness, and the ability to adapt to a fast changing environment. Meanwhile, a new set of crucial skill termed. Methodological skills. These skills include the ability to learn on one's own, to pursue

[9] OECD. The Knowledge-Based Economy. Paris: OECD, 1996.

lifelong leaning and to cope with risk and change. Moreover, diasporas or migration of skilled worker is critical issue that has emerge as well.

2. National innovation system: the NIS concept recognize the fact that innovation and improvements in technical capacity and the result of complex set of relationships among actors creating, acquiring, disseminating, and applying various kind of knowledge. The main actors include private enterprises, universities and public research institutes, intermediaries such as technological zones or parks and relevant financial institution. The basic premise of innovation systems is that innovation cannot happen if these actors are not linked and, therefore, do not interact with each other. Through these innovation systems, structure capital in form of systems processes and new technologies is further developed.

3. Modern economies are characterized by a complex interplay of competition and collaboration between economic actors. The contribution of completion of economic efficiency and productivity is easier to grasp but, some key determinants of growth in knowledge-based economy involve the acquisition of new and emerging technologies. This also requires generation and adoption of scientific knowledge and new technologies, the pursuit of innovation, and the necessary human resources. This also inquires extensive collaboration and networking relevant extensive collaboration and networking with relevant parties across the region and the world. Building networks, whether ICT and sustained by a foundation of social trust building through traditional face-to-face interaction, is one of the major tasks in moving toward a knowledge economy and society.

4. Setting the policy and regulatory: the experiences of developed countries indicated that governments need to established three conditions to attract investment, reduce transaction costs, sustain economic growth and adopted ICT of knowledge-base economy road maps.[10]

Stated by Mika Nieminen and Erkki Kaukonen, governments have currently two basic roles in developing science and technology. First, they provide financial support for research, and second improve the interaction between science and society.

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[10] Asian Development Bank. Moving Towards Knowledged-Based Economy: Asian Experiences. ADB, 2007.

These aspects involve the basic problems the governments have to tackle in their policies by providing sufficient funding for long-term research and researcher training, finding a balance between core and external funding in order to stimulate interaction between academia and society, finding a balance between mission-orient and non-oriented financing for curiosity-driven research, creating measures to stimulate cooperation, removing barriers to cooperation, removing barriers to cooperation, and facilitating the mobility of scientists and engineers. The changing research environment set challenges for the traditional university organization as well. Traditional administrational and decision-making procedures, ways of organization faculties and department, and the way of linking teaching, research and service functions are under pressure to give way to more flexible structures in an environment emphasizing the economic societal relevance of research and training. However, not only the idea that universities should yield applicable knowledge, but also the increasing complexity of scientific problems and research, as well as the development of new multi-or cross disciplinary research area, have posed challenges for university-based knowledge production.[11]

Lan Brinkley mentioned the key features of knowledge economy as follows:

1. The knowledge economy represents a soft discontinuity from the past. It is not a new economy operating to a new set of economic laws.
2. The knowledge is present in all sectors of the economy, not just the knowledge-intensive industries.
3. The knowledge economy has a high and growing and growing intensity of ICT usage by well
4. A growing share of GDP devoted to knowledge intangibles compared with physical capital.
5. The knowledge economy consists of innovating organizations using new technologies to introduce process, organizational and presentational innovation.[12]

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[11] Mika Nieminen and Erkki Kaukonen. Universities and R&D Networking in a Knowledge-Based Economy. Helsinki : Hakapaino Oy, 2001.

[12] Lan Brinkley. Defining the Knowledge Economy: Knowledge Economy Programme Report. [Online]. 2008. Available from: http://www.theworkfoundation.com/ [2011, April 9]

Lorena Batagan mentioned knowledge economy can be characterized by the rapidity of change information and knowledge and products fields. In this economy is important to remark that the barrier of communication and the physical distance are lowest, the value of knowledge and information depends on the situation they are used but the mode in which they are understand by the citizen is important too. Therefore, the government invests in innovation, research, education and technological changes have the most central point to economic performance.[13]

Muntean, Mihaela-Carmen, Nistor, Costel and Manea expressed the emergence of knowledge economy can be characterized in terms of the increasing role of knowledge as a factor of production and its impact on skills, learning, organization and innovation as following;

1. There is an enormous increase in the codification of knowledge, which together with networks and the digitalization of information, is leading to its increasing commoditization.

2. Increasing codification of knowledge is leading to a shift in the balance of the stock of knowledge, leading to a relative shortage of tacit knowledge.

3. Codification is promoting a shift in the organization and structure of production.

4. Information and communication technologies increasingly favour the diffusion of information over re-invention, reducing the investment required for a given quantum of knowledge.

5. The increasing rate of accumulation of knowledge stock is positive growth (raising the speed limit to growth). Knowledge is not necessarily to exhaust in consumption.

6. Codification is a convergence, bridging different areas of competence, reducing knowledge dispersion, and increasing the speed turnover of the stock of knowledge.

7. The innovation system and its knowledge distribution power are critically important.

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[13] Lorena Batagan. Indicators for Knowledge-Based Economy. [Online]. 2007. Available from: http://revistaie.ase.ro/content/44/6%20batagan.pdf [2011, April 9]

8. The increased rate of codification and collection of information are leading to a shift in focus towards tacit (handing skills)

9. Learning is increasingly central for both people and organizations.

10. Learning involves both education and learning-by-doing, learning-by-using, learning-by-interacting.

11. Learning organizations are increasing network organizations.

12. Initiative, creativity, problem solving and openness to change are increasingly important skills.

13. The transition to a knowledge-based system may make market failure systemic.

14. A knowledge-based economy is so fundamentally different from the resource-based system of the last century that conventional economic understanding must be re-examined.[14]

Global trade has expanded because of international trade agreements and reducing of trade barrier. An increasing share of services sector has been extent because of the rapid growth and structural transformation of developed economies. The utilization of knowledge in the process of production substituting the primary of manual labor and physical capital. Consequently, the shares of knowledge-content goods or technologies-content services and products have risen and, the current competitive edge of economies is increasingly sources from technical innovations and competitive use of knowledge than from the abundance of the traditional productive resources. For leading countries in the world economy, knowledge has become the most important factor more than land, tools and even labor. The rapid development in information and communications technology (ICT) help people easily access knowledge across the world. Efficiently and smartly uses of knowledge is one of important factors for economic growth and strengthen capability in international trade

[14] Muntean, Mihaela-Carmen; Nistor, Costel and Manea. The Knowledge Economy. [Online]. 2009. Available from: http://mpra.ub.unimuenchen.de/18256/1/MPRA_paper_18256.pdf [2011, 1 July]

and investment competitiveness. Thus, economy in the globalization era depends much on human resources with science and technology knowledge to create innovation for development which is called knowledge-based economy.

2.3 Relevant researches

Knowledge Korea and Thailand recognize the necessary to transit the economy to knowledge-based-economy as follow;

2.3.1 Korean Knowledge-based economy and education

World Bank reported Korea is currently under strong pressure to shift its development strategy towards becoming an advanced knowledge-based-economy. Prior to crisis, some analysts were already predicting that the growth of Korean economy and indeed that of the rest of the East Asian economies was not sustainable. The Korean press highlighted tasks facing the nation in a series of reports centered on the theme of change, the need for productivity-based growth, and a vision for the future based on knowledge. The press also initiated discussions and dialogue with civil society and business groups on these issues. The government for its part has intensified its efforts to develop an overall knowledge-based development strategy. This has included consultations with leading think tanks (the Korea Development Institute and others), as well as public hearings. The task of mapping out the details of the strategy and the new vision, including that for the knowledge-based economy, was given to the National Economic Advisory Council (NEAC). The NEAC revealed a proposal for a three-year master plan that serve as the blueprint for turning Korea into a knowledge-based economy. The meeting, which was chaired by the president, presented three goals: to make Korea one of the top-ten knowledge and information powers through a massive upgrading of the National Information Infrastructure; to improve education to meet OECD standards; and to enhance the Korean science and technology base to the level of the G7 nations.[15]

According to Ministry of Education, Science and Technology, people and knowledge are critical factors that determine the competitiveness and fate of a nation

[15] World Bank. Korea as a Knowledge Economy: Evolutionary Process and Lessons Learned, 2007:8.

as well as the growth of individuals and corporations in the early years of any knowledge-based society. A new strategy of national development based on the two pillars of human capital and technology innovation. Therefore, Korea has to cope with the limitations of growth driven by labor and capital inputs, with decreasing growth due to low birth rates and population aging, and with deepening income inequality caused by disproportionate investment in human capital. In response to these changes in the policy environment, many advanced nations are striving to develop knowledge and human resources at the national level.[16]

Derek H.C Chen mentioned Korea's design and implementation of knowledge-based development strategies and the resulting rapid and sustained knowledge-led economic growth over the past four decades provide a wealth of valuable policy lessons for other developing economies. First, and particularly important, are the coordinated and complementary expansion of the four pillars of the knowledge-based economy framework: economic incentive and institutional regimes, educated and skilled workers, an effective innovation system, and modern and accessible information infrastructure that evolved in the economy's various stages of development. These pillars provided the economy with the necessary means to effectively acquire and use knowledge to improve productivity and enhance long-term economic growth. Second, the strong and effective leadership provided by the government, which led to the coordinated development of the education, innovation, and ICTs pillars, was particularly important during the earlier stages of industrialization, when appropriate institutions to coordinate an economy-wide development agenda were not yet sufficiently established. The role of Korean government has appropriately mellowed in recent times to allow the market to further spur economic activity. Third, the economy-wide reforms and the array of policy measures that were implemented after the 1997 crisis serve as good examples of making the best use of opportunities to improve economic conditions. The government initiated the formalization of the action plan, but also sought support from the civil society and some media groups. One outcome of those measures was

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[16] Ministry of Education, Science and Technology. [Online]. 2007. Second Five-Year Basic Plan for National Human Resoueces (2006-2010). Available from http://english.mest.go.kr/web/1711/en/board/enview.do?bbsId=260&boardSeq=1369&mode=view [2010, March 27]

the successful wiring of the Korean economy and the public, resulting in a first-class information infrastructure. Fourth, educational basis has been built and gradually expanded and the way technology has been gradually mastered and upgraded throughout the stages of industrialization. Although Korea has made these advances, it needs to continue and increase efforts in reforming its higher education and innovation systems. These pillars have not sufficiently evolved in recent years to meet the demands of the current global economy, in part as a result of several pockets of resistance inherent in the Korean society and culture. In addition, a more proactive policy response is required to achieve more-balanced economic development across the different sectors and niches of the economy. Concrete steps to resolve these issues will eventually become critical to Korea's continued transition to the knowledge economy and further sustained economic growth.[17]

Lee Pil num asserted since the advent of the knowledge-information society of the 21st century emphasizes the ability to create and utilize innovative knowledge in the process of generating wealth as the key factor of a nation's competitiveness, human resource development applied to all citizens has become a core strategy for national development.[18]

According to Jong Wha Lee, Korea has achieved a remarkable record of high and sustained economic growth and human development. It is noted that economic growth and human development have been closely related and interacted with each other throughout periods of high economic growth. First of all, human capital is considered one of the major factors in explaining Korea's remarkable economic growth. The contribution of human capital to growth goes beyond that indicated by conventional growth accounting because the abundant well-educated human resources have been playing a key role in the absorption of advanced technology from developed countries and thereby bringing about Korea's high levels of technological

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[17] Derek H.C Chen. Korea as a Knowledge Economy : Evaluation Process and Lessons Learned. Wachington, D.C : The World Bank Instiute, 2006.

[18] Lee Pil num. Human Resource Development Policy. [Online] 2010. Available from: http://english.mest.go.kr/web/1711/en/board/enlist.do?bbsId=260 [2010, March, 23]

progress. On the other hand, human development itself has undoubtedly benefited from the strong demand for education triggered by the growth of income. However, Korea's unprecedented growth of education indicates that the accomplishment in human development is not just an outcome of economic growth itself but, rather, can be attributed to special features of the Korean growth strategies that were pursued with both equity and outward-orientation. We show that outward-orientation was critically important to rapid growth of human capital. Because outward-oriented strategies generate ample opportunities for new employment and much higher compensation for human capital, they have encouraged the Korean people to invest more in accumulation of human capital. In addition, the Korean government, facing global competition in its outward orientation, has been actively involved in education and training of workers. A combination of high growth and equitable income distribution is another key factor in Korea's achievement in human development. Throughout the period, Korea has demonstrated relatively equal income distribution, which has enabled the majority of the people to afford education, in particular, at the higher levels. Future research will reveal more details about the characteristics of Korea's human development. In particular, some measures indicate that Korea has achieved outstanding quality of education as well as quantity of education for the last three decades. Further investigation of this issue will improve our understanding of Korea's economic success.[19]

Hakchung Choo and Kimoon Cheong asserted the experience of Korean economic growth has now become a classic example of a successful story of development and industrialization. It is very often said that the rapid economic growth and industrialization of Korea since the early 1960s is primarily attributable to its people, not only diligent but also well-educated. When Korean economy initiated its modernization and development in the early 1960s, it had almost nothing but human resources as meaningful factors of economic growth and development. Due to its historical reasons, Korea had all of the disadvantages of underdevelopment: a lack of accumulated capital and technology and a scarcity of appropriate institutions and

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[19] Jong Wha Lee. Economic Growth and Human Developemt in the Republic of Korea, 1945-1952. [Online]. 2007. Available from: http://hdr.undp.org/en/reports/global/hdr1997/papers/jong-wha_lee.pdf [2010, March 15]

enterprises. The only asset that Korea could rely on for its economic growth and development was its abundant human resources with a relatively high level of education, motivation, trainability, and ability to work together. Many studies on the Korean economic development have found that the human resources have been the most important factor in the process of economic development. Especially, education and learning has been viewed as the most important necessity for Korea's sustained economic growth and development. This can be attributed to a number of factors, but most fundamental has been the historically deep-rooted value placed on education by the Korean people.[20]

2.3.2 Thailand's knowledge-based and education

World Bank indicated the poor quality of education and insufficient of industrial skills are the problem of Thailand's transformation to knowledge-based economy to compete with other leading East Asian countries. Higher education helps to solve the deficiencies of S&T skills acquisition by bringing workers to meet the needed standards of technical ability. The most common complaint of Thai employers are the short supply of skilled workers especially, computer and IT skilled workers and those who have English knowledge. High investment in R&D may not have been necessary for Thailand because there were sufficient existing processes for technology transfer to achieve the desired level of technological growth and capability. However, for Thailand still need to accelerate own attempts to become more innovative and maintain a player in the leading industries to offer a more range of products and services. Thus, the country is necessary to upgrade technological capability to a higher level.

Office of the National Economic reported the increase in total factor productivity (TFP) between 1977 and 2004, accounted about one percent point to total growth of Thailand. This is because of workforce transformation from low productive jobs in rural areas to more productive employment especially in the manufacturing sector of urban areas. However, total factor productivity growth within the

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[20] Hakchung Choo and Kimoon Cheong. Some Lessons from Korea Experience in Human Resource Development. [Online] 2010. Available from: http://cc.kangwon.ac.kr/~kimoon/papers/hr-lessn.htm [2010, May 21]

manufacturing sector has been limited. For some time, there were continue of the transformation of labour forces from rural areas to more productive jobs while 42 percent of Thailand's workforces is currently employed in the major sector. The productivity bonus will persist so long as higher value added jobs continue increasing. However, the trend growth inclined to decrease. As Thailand has participated in the ranking of middle-income countries, efficiency enhancements and innovation within the manufacturing and services sectors helped to increase most of the gains in productivity. A consistent and sustained focus on technology by government support, policies and effective leadership can enhance the importance of technological innovation for economic of Thailand in the future. The outcomes of such attempts can be seen from unwavering engagement to developing a knowledge-based economy contributed to Korea and Taiwan's technological rising from a moderate original base of human capital and natural resources.[21]

Kriengsak Chareonwongsak mentioned that Thailand should not be just creative economy but to be a knowledge-based economy. Nowadays, there are currently very little Thai intellectual property and registered patents or innovations by Thais. Likewise, there are few academic papers published in journals by Thai academics thus, pushing Thailand forward to be a knowledge economy will be hard work for Thailand's government, with full reform needed in such areas as human resource reform. Most Thais lack thinking skills and several personal values are also obstacles. The government should push human resource reform through education in order to mold Thais who are smart, ethical and courageous. All Thai children should be able to access the education system and all schools should have class-based skills development courses, and use the best and most innovative teaching media in their classrooms. The Ministry of Education must monitor the direction and quality of

[21] Office of National Economic and Social Development Board. Towards a Knowledge-Based Economy in Thailand. Bangkok, 2009.

education, and promote the private sector to be a main power in support education provision. [22]

Wichit Srisa-an further asserted that the modem world is a world of knowledge-based development. Fundamental determinants of global competitiveness depend on access, creation and utilization of knowledge. They are also determinants of the level of development. Knowledge is, therefore, a dividing line and also a gap between advanced countries and developing countries. As knowledge increases, the gap is widen. Developing countries are lagging far behind. They need strategies and knowledge management in order to benefit from knowledge revolution. They have to develop knowledge-based economy through an access, creation, and use of knowledge. From knowledge revolution, developing countries can tap, adapt, and adopt knowledge from abroad. Knowledge could be created and developed to meet special needs of the country. Knowledge -based economy consists of the following important components: (1) Human Resource Development (2) Research and Development, (3) Dynamic Information Infrastructure) and (4) Science, Technology, Innovation. Human resource development is required to produce knowledge workers for the knowledge-based economy. Research and Development is the foundation for access, creation, and knowledge. ICT is needed for easy access and dissemination. Science, technology and innovation are the sources of new quality products and services. These components are necessary for the knowledge-based society. The driving force moving these four components is education. But only quality education can be the driver. Therefore, Thailand needs education reform for the development of knowledge-based society. Human recourses development should aim at producing quality knowledge workers in sufficient numbers. In order to create knowledge, innovations, and technologies necessary for knowledge-based society, following measures are important: Support and strengthen research and development of higher, education institutions, government agencies, and private sector. Mobilize resources

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[22] Kriengsak Chareonwongsak. Not just Creative Economy but Knowledge-Based Economy. [Online] 2010. Available from: http://lungkriengsak.blogspot.com/2010/12/kriengsak-chareonwongsak-not-just.html [2011, July 4]

and promote investment in Research and Development by using tax exemption as incentives or other measures as appropriate.[23]

Korean and Thai government still step forward for human resources development for 21st Century due to the changing of economy and society which knowledge play important role in people's life. As knowledge-based industries are playing increasingly important role in the Korea and Thailand's, the process in technology is directly contributing to economic growth and demand for highly skilled and creative workforce is on the continuous increase. Therefore, it is necessary to enhance education, especially higher education and research capacity in universities to become knowledge creation and foundation of the two countries.

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23 Wichit Srisa-an. The Future of Thai Education. [Online]. 2010. Available from: http://www.inter.mua.go.th/Project/Leadership%20program/The%20Futre%20of%20Thai%20Higher%20Education.pdf [2011, June 3].

CHAPTER III
METHODOLOGY

This research is descriptive research. I used documentary research and interview by dividing into two sections as follows:

First section: direction of higher education development in Korea for knowledge-based economy (1999-2012) and Brain Korea 21 project. Research process as follows:

1. Higher education development in Korea, Korea transition to knowledge-based economy and, Brain Korea 21 project's background and significant of the program by studying documents and relevant researches.

2. Interview with informants of Korea's education. The interview issues as follow:

2.1 How higher education support economic development of Korea.

2.2 How the promotion of research and development (R&D) support economic development of Korea.

2.3 The trend of higher education and R&D of Korea in the future

2.4 Brain Korea 21 significant and effect

3. Summarize research result: Korea's human resources development and knowledge-led growth strategies.

Second section: direction of higher education development in Thailand for knowledge-based society (2010-2012) and National Research Universities project. Research process as follows:

1. Higher education development in Thailand for knowledge-based society and, National Research Universities' background and significant of the program by studying documents and relevant researches.

2. Interview with informants of Thailand's education. The interview issues as follow:

2.1 How higher education support economic development of Korea.

2.2 How the promotion of research and development (R&D) support. economic development of Korea.

2.3 The trend of higher education and R&D of Korea in the future

2.4 National Research Universities' significant and effects

3. Summarize research result: Thailand's human and knowledge-led growth strategies.

4. Research result from both two-phase analyses would help to understand Brain Korea 21 project's advantages to strengthen higher education capacity for knowledge-based economy and conduce to propose appropriated policy for Thailand's higher education institutions development.

3.1 Research Scope

The research focuses on;

1. Higher education development in Korea between 1999 to 2012
2. Higher education promotion in Thailand between 2010 to 2012
3. Korea and Thailand as knowledge-based economy
4. Brain Korea 21 and National Research Universities Significance

3.2 Data collection

1. Collect and study relevant documentaries.
2. Collect data from interview with informants of Korea and Thailand.

3.3 Informants

The informants must have knowledge, experience and position related in the issues. I contacted them by telephone, e-mail or send letter to them prior to interview. The informants divided into two groups as follows;

3.3.1 Korean Informants. I interview the officer of Ministry of Education, Science and Technology and Chairman of Brain Korea 21.

3.3.2 Thai informants. I interview professors who are responsible about National Research University project from 4 universities; Chulalongkorn University, Thammasat University, Mahidol University and Kasetsart University.

3.4 Research Instruments

I used documentary sources and interview to be the instruments for collecting data.

First, documentary sources such as books, research papers, journals, and websites were used to study higher education development to knowledge-based economy in Korea and Thailand. Then the document and research paper that related to Brain Korea 21 and Thailand's National Research Universities were used to support and examine the significance of higher education promotion by nurturing research in universities.

Second, Interviews about Brain Korea 21 and National Research Universities were conducted to support and examine the detail and importance of the project to enhance research capacity and promote higher education for knowledge-based economy.

3.5 Data analysis

1. Analyze data from relevant documentaries by content analysis.
2. Analyze data from interview with informants of Korea and Thailand.
3. Bring analysis result to propose appropriated policy for Thailand's higher education institutions development.

CHAPTER IV
HIGHER EDUCATION DEVELOPMENT IN KOREA AND THAILAND

This chapter intends to illustrate the detail of higher education development in Korea and Thailand. Information shown below would be detailed into 2 main sections.

Section 1

Direction of Higher education development in Korea, Korea transition to knowledge-based economy and, Brain Korea 21 project's significance.

1. Higher education development and Korea transition to knowledge-based economy.

2. Brain Korea 21 project's significance.

Section 2

Direction of higher education development in Thailand for knowledge-based society (2010-2012) and National Research Universities' significance.

1. Higher education development in Thailand for knowledge-based economy

2. National Research Universities' significance.

Section 1

Direction of Higher education development in Korea, Korea transition to knowledge-based economy and, Brain Korea 21 project's significance.

1. Higher education development and Korea transition to knowledge-based economy.

Higher education aims to provide the knowledge and skills required to development of Korean society and country. The Ministry of Education (MoE) is encouraging reform of higher education to promote global competitiveness of universities thorough diversification and specialization.

The Higher Education Act states propose of universities that to build up character, teaching and research profound knowledge and skills which is necessary for the advancement of society, country and mankind (Article 28).[1]

There was a rise in number of universities over the last decade. Even though higher education has considerably expanded in quality, the development of human resources to meet social and national need has been insufficient. Therefore, the government has laid down measures to increase the internationally competitiveness of higher education to meet society's demand of 21st century. Those goals are:

1. Increase international competitiveness of higher education.
2. Increase 10 percent employment rates of graduates.
3. Become one of top 100 universities for SCI level research submitted.
4. Increase knowledge transfer between industry and academia.
5. Increase ratio of faulty and student.
6. Provide an education which better prepares student for industry's needs, using more various and specialize programs, and to develop 15 world-class research oriented universities by 2010.

Present economic policy encourages continue strong manufacturing sector with higher technological base more than a significance shift towards the service sector. Thus, knowledge-base industries have expended essentially and higher education investment plays an important role in Korea. Development strategies have emphasized on sustained productivity growth. A highly educated labour force was necessary for consistently increasing value-added of output.

There are many changes in higher education. Quantitative expansions in higher education have led to compromising educational standards, learning environments and an oversupply of graduates. Moreover, international trade agreements, such as GATTS, WTO and FTA, have influenced on higher education and recruiting practices. However, high educated students able to fill positions in national strategic industries are still insufficient. The government tries to solve many problems related to education. The many of the issues raises by the Education Reform

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[1] Korean Educational Development Institute (KEDI). OECD Thematic Review of Tertiary Education: Country Background Report for Korea. Seoul: KEDI 2006 :11.

Committee have been reflected in policies, system, and funding projects so, higher education has change significantly.

After economic crisis in the mid-1990s, Korea tried to transform the Korean economy to a knowledge-based one. The government has tried to build up the information infrastructure and existing technologies. However, Korea had to depend heavily on foreign technologies and attempted to accumulate technological capabilities. Korea imported technologies while improved domestic research and development (R&D) efforts.

One of faculties' duties in Higher Education Act (Article 15) is to educate and instruct students and conduct research. Therefore, MOE is pushing the establishment of universities which is emphasis on joint research between universities and industries. The universities would facilitate the transfer, education, research, and development of new technologies and would become the local cluster for regional innovation. Industry-academia cooperation by each university will help to increase transfer and innovation.[2]

The government-led development plans have been reflect in education policy and planning. Korea has been successful in providing and expanding, the education system based on the industrial needs of human resource. In consequence, Korea education's system developed at the same time with economic development and completes the other pillars. At the beginning, the government's educational plans emphasized on primary and secondary education then move to higher education according to economic advancement.

There was a strong effect on human resource development from rapid economic growth in two ways. For industrial side, rapid industrialization affects skill formation in workplaces, especially industries which required high skills and knowledge. For the other side, there were requirements in education and training system responded of new industry and economic growth. The major changes in Korean economy and education development are shown in table 5.

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[2] Korean Educational Development Institute (KEDI). OECD Thematic Review of Tertiary Education: Country Background Report for Korea. Seoul: KEDI 2006 :55.

Table 5: Korea's Economy and Education Development

Periods	1948-1960	1961-1980	1981-2000	2001-Present
Economy	Reconstruction and establishment of postwar Korea	Export acceleration and high development	Economic reconstruction and sustainable growth	Reconstruction period and knowledge-based economy
Challenges to Education	Basic education and expansion of elementary education	Expansion and equalization of secondary education and vocational education	Higher education expansion , Education reform, and pursuit of education sustainability	Competitiveness in knowledge-based society
Policy Choices	Universal compulsory education	Education reform and expansion of higher education	Higher education reform and quality improvement	Restructuring higher education, support research, and human resource development
Sources/ Tools	Foreign assistance	- Five year planning - Law of local education finance funding - Foreign loan to support vocational education	- President commission for education reform (PCER) - Education Reform (1995)	Education and financial support for higher education (Brain Korea 21, NURI)

In knowledge-based society, higher education attracts attention and importance in education policies. There were two factors which caused policy changing. First, the government foresees the significance of the quality of human resources as the key factor in future economic growth. Second, current higher

education system in Korea is lower than expect in term of efficiency of education spending. These lead to education reforms in higher education system in Korea.

The changing government's policy in the mid 1990s effected higher education especially in term of education reform. The Kim Young Sam government (1993-1997) established the Education Reform committee to cope with the arrival of information and globalization.[3] The government also strengthened national S&T projects and R&D program. Afterwards, the government of Kim Dae-Jung (1998-2002) began to establish measure to encourage the research activities in universities. The Brain Korea 21 (BK21) was established to support university researchers, especially young faculty members and postgraduate students, to produce high quality research output which could be published in internationally peer-review journal.

President Roh Moo Hyun continued to promote the BK21 (2003-2007) in order to empower young scientists and postgraduates to the internationalization of R&D. During the Lee Myung Bak's government (2008-present), there was the reform scheme to raise competitiveness of Korea higher education.[4] The aspect of policy objectives were divided as follows;

1. Strengthen the educational capacity of higher education institutions by improving teaching and learning environments to encourage competition among institution and promote their competitive strength.

2. Raise the autonomy and accountability of higher education institutions by introducing new schemes such as the admission officer system, higher education disclosure system and evaluation & accreditation system. However, institutions are being required to strengthen accountability and build infrastructure for self-development.

3. Enhance the research capability of higher education institutions. The government tries to foster research-oriented institutions with the World-Class

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[3] Kim, Young-Chul. Understanding Korean Educational Policy. Universalisation of Tertiary Education. p 25. Seoul: Gyeong Seong Printing. 2008.

[4] Ibid.

University project and other funding projects. Moreover, individual scientists and small-scale research groups were support as a way to nurture creativity in research.

Therefore, the key strategy for transition to knowledge is to upgrade research capability and strengthen the link between universities and industry. Generally, the institutions of higher education were not enthusiastic to encourage competencies in engineering and science. Most applied research was conducted by government research institutes and private sectors. Thus, the government set up the projects to strengthen the research capacity of universities. Brain Korea 21 is one of those project aims to improve the research infrastructure and graduate-level training of higher education institutions for intensive human resource development.

There has been poor interaction between universities and business at technical level because most large companies have built up their own training and education facilities. As Korea transition to knowledge-based economy, knowledge accumulation and transfer are major strategy and must be based on active exchange and collaboration among human resources of universities, government research agencies, and private industry. BK21 is one types of cooperation between industry and academia by upgrading universities that conduct research in their graduate schools and turn them into research centers.

2. Brain Korea 21 project's significance

As economic become more advancement, technological competences become a crucial factors. In the past, Korea's economic success relied on imitation. Korean industries attained technological capability through informal channel of technology transfer thus, FDI played an important role in technological learning aligned with worker's technological absorptive capacity.

Today, Korea still imports an importance technology and knowledge from aboard but, the country tremendously increases research and development (R&D) by spending almost 3 percent of GDP on R&D and aims to increase to 5 percent of by

2012.[5] However, most of amount of R&D conducted by private sectors, especially by the Chaebols. It could be said that the innovation system in Korea is still weak:

1. Applied R&D has been over emphasized and basic science resources, which are essential investment for long-term development for S&T, are inadequate.

2. The innovation in industry from small number of Chaebols is not very active. Technological diffusion among domestic firms are deficiency and importation foreign technology is still monotonous. Moreover, the diffusion from research institutes to private firms is not efficient as expect.

Furthermore, Korean universities have not been able to provide both appropriate human resource and relevant industrial research. There is only 10 percent of R&D University research has only from university research, which is a low level and performance. These situations reflect Korean university research environments:

1. Professors can not devote to research because of teaching accountability.

2. Graduate programs have not been well developed because many universities emphasize on teaching at the undergraduate level. Universities also are very poor in research facilities, and university education is not linked to research.

3. University professors are lack of motivation to conduct research because they see research as automatic task once they employed. Thus, they do it without serious efforts.

From these factors, the government set up various measures to turn universities to more research-orient institutions. Brain Korea 21 (BK21) is one of measures which is supports selects universities in their transformation into research-oriented and graduate education-oriented institutions.

2.1 Background

The Korea Ministry of Education and Human Resource Development (MoE), in response to concern over the relatively low standing of the nation's universities and researchers, launched the Brain Korea 21 in the late 1990s.

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[5] Deven Swezy. South Korea to Invest 5 Percent of GDP in R&D [Online]. 2009 . Availeble from: http://thebreakthrough.org/blog/2009/11/south_korea_to_invest_5_percen.shtml [2011, Aug 12]

BK21 aims to foster globally competitive research universities and graduate program and to breed high-quality research manpower in Korea by providing funding to graduate students, post doctoral fellow and contract-based research professors who belong to research groups (Sa-Up-Dan) at top universities. Recipients are selected for the benefit of the research groups and universities to which they belong, not on individual merit. However, the program does not support the labor cost of faculty members participating in the research groups or capital cost of university research and development (R&D). These costs are supposed to be financed by other sources.

2.2 Vision

Brain Korea 21 project recognizes the necessary to develop Korea's human resources by provides financial support to graduate student, reforming university education and establishing research infrastructure. The overall objectives are described as follows:

1. Developing world class expert group by fostering top class expert in technologies and producing next generation scholars in basic science, humanities, social science.

2. Upgrading university education and research infrastructure by establishing infrastructure related to graduate schools. Universities will be support financially in establishing relations with world-leading universities for international exchange program or research collaboration. Post doctorate students and faculties will receive allowances or scholarships.

3. Nurturing graduate schools by enhancing regional graduate schools' research capabilities through the promotion of specialization. Practical major education will be strengthened and basic vocational education on foreign language and information management. Development of regional R&D human resource cluster will be focused. The participating regional universities have to hire more professors to improve student and faculty ratio by forming cooperation with local government and firms. Professors will receive financial support for laboratory and language labs.

2.3 Goals

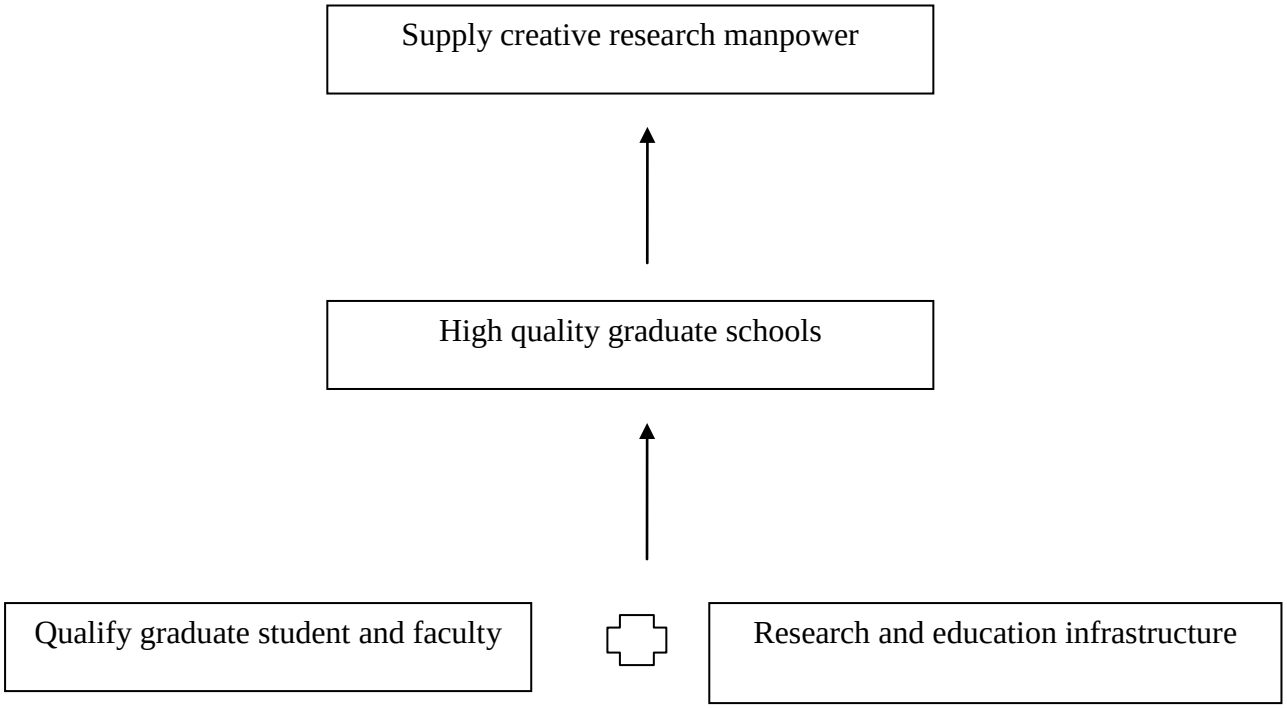
BK21 could be divided into two goals. The first goal is to enlarge the size and capability of the research manpower pool that can create new knowledge and new technology. The second goal is to nurture internationally competitive graduate departments and research universities. While the first goal focuses on nation, the second goal focuses on individual departments and universities.

2.4 Mission

1. Improving the research capabilities of faculty and graduate students.
2. Enhancing the quality of research and training.
3. Helping establish infrastructure of graduate schools.
4. Promoting regional universities, also seek to build regional innovation cluster.

It could be said that the missions which are aligned with the goal are supporting excellent research groups and building physical and institutional infrastructure for internationally competitive department and program. In other words, Korea need high quality graduate schools (second goals) to train and supply research manpower (first goals). It is necessary to have better qualified graduate students and faculty, which consist of superiority (first mission), and building physical and institutional infrastructure for internationally competitive department and program (second mission) to have stronger graduate schools and programs (second goals) as shown in figure 9.

Figure 9: Brain Korea 21 Goals and Missions



2.5 Expected outcomes

1. Providing more incentive to pursue students to obtain advanced degrees by reducing the expected cost.

2. Providing stability for postdoctoral researchers in their transition to permanent academic jobs.

3. Increasing manpower for research activity

4. Giving flexibility to carry out boarder research agendas to develop university or department excellence.

2.6 Inputs

Inputs are BK21 funding and rules of the program to complete missions and goals. The rules are reflected in strategy, unit of support, selection criteria, evaluation criteria, and other operational mechanisms.

2.6.1 Funding

BK21 funding covers scholarships and allowances for graduate student, postdoctoral scholars, and contract-based researchers but does not include professor's labor cost or cost of equipment and facilities. BK21 project provides fixed payments for recipients every month. University presidents are contractually responsible for BK21 funding; leaders of the research group have practical responsibility for deliverables. The university receives the allowances and pays the monthly stipends to graduate students, post doctoral researchers and contact-based researcher of the selected apartment. Scholarships and allowances for graduate students, post doctoral researchers and contact-based research professors are about 70-80 percent of the funds and the remainder goes for international collaboration and other expenses. However, research groups are expected to find other funding for research projects, equipment and facilities.

Qualifications for BK21 funding are as follows:

1. A research group must have a doctorate program with enrolled PhD candidate.

2. The number of faculty members participating in the research must be at least seven for liberal arts and social science groups, ten for basic science groups, and 10-25 for applied science groups.

3. Participating professors must also produce or exceed a minimum average number of publications for three years.

4. All research groups must secure matching funds from their universities equal to at least 5 percent of the level of BK21 funding that they seek.

5. Applied science and interdisciplinary science research group must secure matching funds from industry sources equal to at least 10 percent of BK21 funding.

6. Regional university research group must secure matching funds from local government equal to 3 to 5 percent of BK21 funding, depending on discipline.

2.6.2 Strategy

BK21's strategy is to pick winner and concenter support on them. During Phase I, the top five recipient universities (SNU, KAIST, Korea University, POSTECH, and Yonsei University) accounted for 53 percent of the BK21 program budget, with SNU accounting for 34 percent. While Phase II top five were SNU, Yonsei University, Korea University, Sungkyunkwan University and Pusan National University account for 44 percent. BK21 funds ate designed to subsidize a university's R&D costs, lower the cost of getting PhDs and master degrees, and stabilize the income of post-doctoral students and young researchers in early career transition.

2.6.3 Unit of support

BK21's unit of support is the department-level research group. Students and young researchers are matched with faculty members to form a research group. Qualification of BK21 Funding for research groups are as follows:

1. A research group must have a doctorate program with enroll with enrolled PhD candidates.

2. Liberal arts and social science groups must have at least seven participating faculty members; at least ten for basic science; ten to 25 for applied science group.

3. Most faculty members of the department should participate in the research group.

4. The leader of the research group should be a faculty member who can lead the group until the end of the BK21 program period and should not lead other large-scale government funded research projects.

5. Participating graduate students should spend at least 40 hours weekly on research and education, while participating professors should also have had a minimum average number of publications.

6. All research groups need to secure matching funds from their universities equal to at least 5 to percent of the level of BK21 funding that they seek.

7. Applied science and interdisciplinary science research groups must secure matching funds from industry sources equal to 10 percent of the BK21 funding. While regional university research group must secure matching funds

from local government equal to 3-5 percent of BK21 funding, depending on discipline.

8. Permanent member of the research group is the leader of the department to ensure performance from each team member.

2.6.4 Recipient selection criteria

Selection criteria are research merit, training, links to university, university reform, specialization and regional development for region university level groups. Research groups or teams are selected on the ranking merit, which is called the competition rule, and ranked within academic discipline. For different groups, ranking criteria are weighed differently. For applied science groups criteria are weighed equally. For basic science groups, education and research development excellence are weighed equally and given slightly more weigh than university reform and specialization. Each group winning funding receives the amount it requested as long as It meets general guidelines on distribution and the total amount requested by all groups in each academic panel, which are Basic Science, Applied Science, and Arts and Humanities, is within the range of pre-announced funding.

2.7 Outputs

Outputs are the products of research. As BK21 Phase I enabled a boost in research capacity and develop human resources with global competitiveness by producing Master and PhDs, particularly in the science and technology field as seen in figure 10 and 11.

Figure 10 : Number of Students or Researchers Benefited from BK21 Phase I

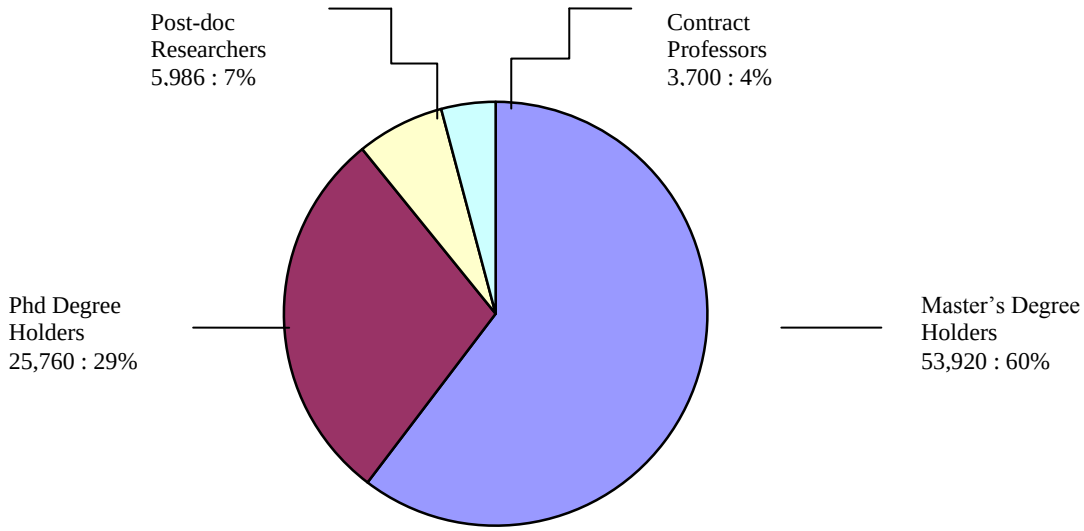
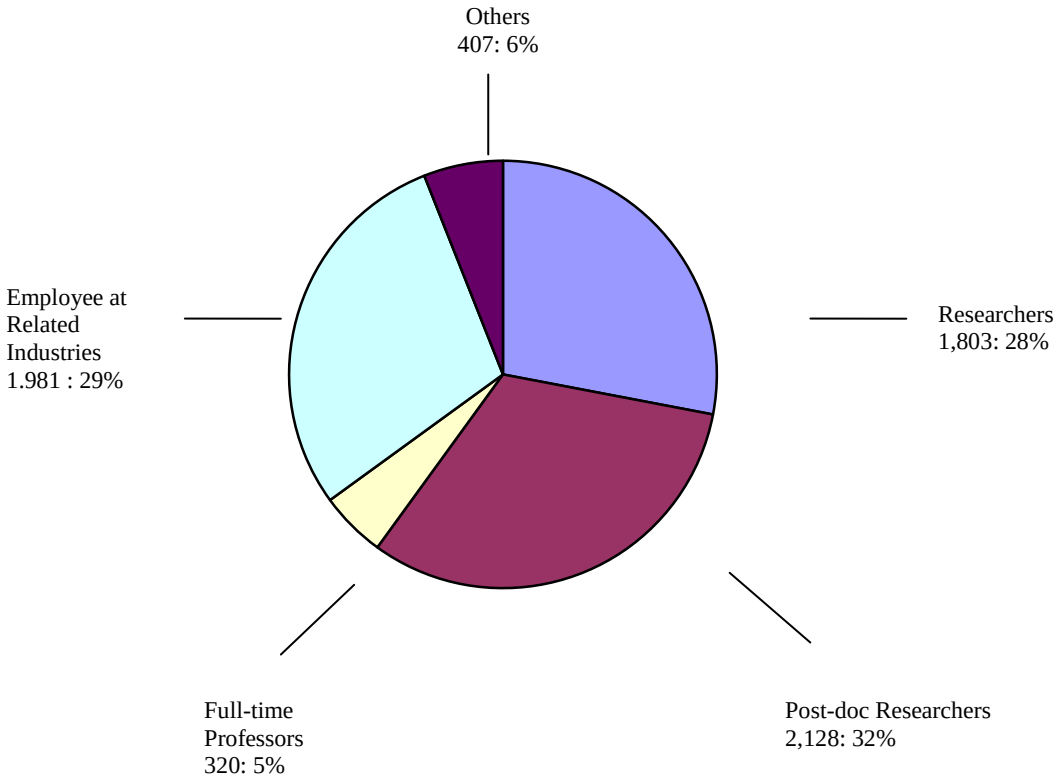


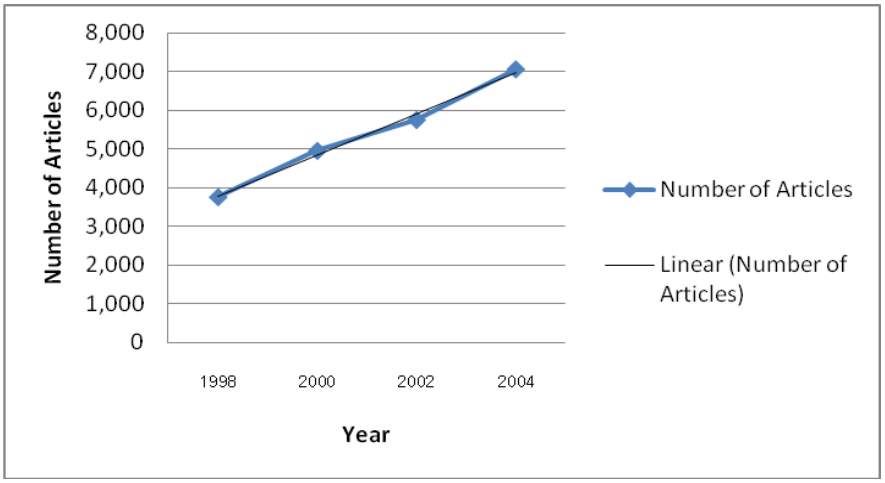
Figure 11 : Employment in PhDs in Science and Technology from 1999-2005



Source: Brain Korea 21, p 19.

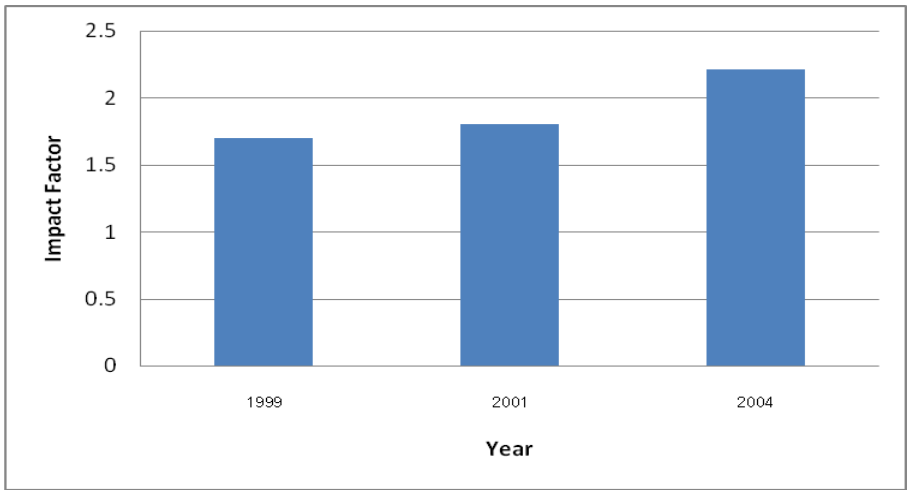
Moreover, the number of SCI-level articles produced by professors participating in BK21 program increased from 3,765 articles in 1998 to 7,060 in 2004 which are doubled over the period as indicated in figure 12.

Figure 12 : Number of SCI-level articles produced by professors participating in BK21 Phase I



The average in impact factor per articles in science and technology increased from 1.70 in 1999 to 2.21 in 2004.

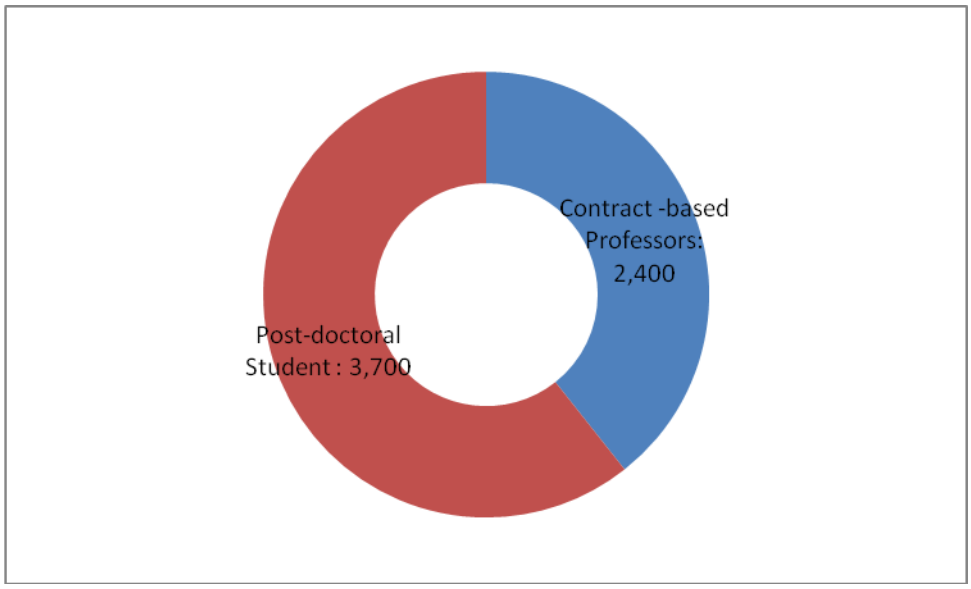
Figure 13: The Average in Impact Factor per Articles in Science and Technology (1999-2004)



Source: Brain Korea 21, p 19.

BK21 led to instructional reform and competitive effects as well. The program achieve in establishing research environment within and among universities by inducing a central fund management system and conducting close evaluation on faculty performance. Universities will be more able to downsize or close weak departments and encourage weak faculty members to leave by making obvious determinations about quality and linking those one to funding. Universities which failed to obtain funding in Phase I reformed their institutional structure by increasing recognition of the important of top talent and decrease tolerance for ordinary performers. Some university offers bonuses to professors who published in top journals and had also established a special scouting fund to recruit top professors by paying higher salary.[6] These universities also hire more postdoctoral researchers to increase the number of publications produced by their institutions which has lead to encourage improvement in research climate of universities as shown in figure 14.

Figure 14: Number of New Researchers Received Grants from BK21 (1999-2004)



Source: Brain Korea 21, p 7.

[6] Somi Song, Steven W. Popper, Charles A. Goldman and David K.Evans. Brain Korea 21 Phase II: A New Evaluation Model. Pittsburgs: RAND Corporation, 2008.

2.8 Outcomes

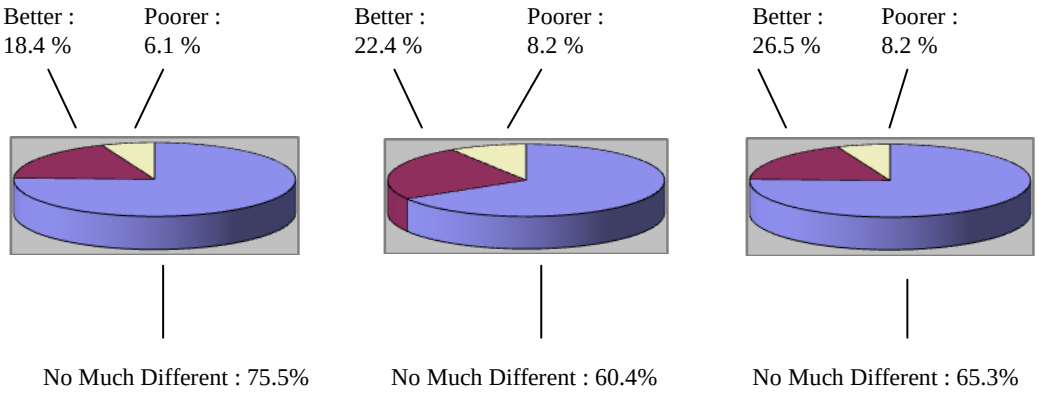
BK21 supported universities to achieve international prestige. Korea's world ranking set by the number of articles in SCI-recognized journals increased from 18th in 1998 to 13th in 2004 as seen in table 6. The program also improved the size and quality of the pool of knowledge manpower in Korea, for example, research capacity, job performance and, problem solving capacity of BK21 PhD and PhD educated aboard are not much different as shown in figure 15.

Table 6 : Number of Articles in SCI-recognized Journals

	1998	2000	2002	2004
Number of articles	9,444	12,013	14,916	18,497
World ranking	18	16	13	13

Source: Brain Korea 21, p 7.

Figure: 15 Comparison of capacities between BK21 PhDs and PhDs educated in advance countries



<Research Capacity> <Job Performance> <Problem Solving Capacity>

Source : Brain Korea 21, p 19.

After the success of BK21 Phase I, the government started Phase II in 2006. It will further develop research-orient universities and cultivate expert in core technologies and new industries which recognized as new growth engine and will

drive Korea's economic growth in the future. The second phase emphasizes on facilitating the specialization of graduate schools and industry-academia collaboration. Moreover, the first phase would be identified the problems and issued measure for improvement in second phase as indicated in table 7.

Table 7: Problems and Measures for BK21 Improvement

Division	Results from Phase I (Problems Identified)	Improvement Measure from Phase II
Goals	- Heavy focus on research outcomes - High pressure for university reform - Indistinct differentiation between program categories	- Emphasize the improvement of human resource (in link with R&D initiatives) - Induce reforms that have a direct impact on the development of research-oriented universities. - Differentiate program goals for each category
Eligible Categories	- Emphasized on applied science but, lack of support for basic sciences and interdisciplinary studies - Disorganized and overlapped programs	- Support more basic sciences and introduce a new inter-disciplinary program category - Introduce a new global service program category - Abolish the regional university development program and graduate schools infrastructure program
Industry-academia Collaboration	- Lack of industry-academia collaboration	- Evaluate universities' efforts to build various industry-

	- Program evaluation focused on research outcome only	academia collaboration program - Strengthen evaluation indices related to university-industry partnership such as employment and technology transfer rates
Balanced-regional Development	Graduate school program centered in the metropolitan area resulted in widening gap between the metropolitan and regional area	Introduce a new regional graduate school of excellence program in facilitating local innovation and regional graduate school specialization.
Evaluation and Management	- Lack of competition system - Lack of systemized evaluation system	- Conduct expert program evaluation on a regular basis - Mandate universities to conduct self-evaluation - Introduce a program exclusion/admission system - Build a comprehensive information system and enact a law on operation regulations

Source : Source: Brain Korea 21, p 20.

Section 2

Direction of higher education development in Thailand for knowledge-based economy (2010-2012) and National Research Universities' significance.

1. Higher education development in Thailand for knowledge-based economy.

In the era of globalization, higher education plays important role in creating competitiveness in international market. Social demand for higher education has

increased to respond to generate and preparing gradates for an increasing global economy. Before the Asian Economic crisis, Thailand's economy expanded rapidly. However, the expansion was not accompanied with productivity gains because necessary investments in research and development (R&D) and human resource development in Science and Technology (S&T) then, the economy growth capability decreased and became weak.[7] Hence, there is requirement for establishing economy's sustainable growth. The government tried to accelerate the R&D capacity and human resource development in S&T and higher education is seen as a key factor for the success of national. There have been attempted to diversify institution into research universities in order to guarantee quality of institutions in higher education system. The factors affected Thailand are as follows;

1. Demographic changes

The increase natural growth rate of population in 2010-2020 tends to reduce due to the decline of birth rate and Thailand is becoming aging society in the future.[8] The children and working age population incline to decrease continuously. This results in the decrease of the number of higher education student and the number of labour force in the future. While the aging population tends to be increase which results in the capacity of workforce. The old workers might not be able to effectively learn to use advance technology to achieve high economic growth rate. Thus, higher education is one of the main key to solve these problems.

2. Employment and labour market

The employment and strong labour market are key factors for national development. Most of Thai labour work in agricultural, tread and service and manufacturing respectively. Thai industry is under pressure to raise the competitive capacity to compete with neighboring and other countries especially, when faced with

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[7] Office of National Economic and Social Development Board and World Bank. Towards a Knowledge-Based Economy in Thailand. [Online]. 2007. Available from: http://siteresources.worldbank.org/INTTHAILAND/Resources/333200-1130224663121/2008feb-ke-thailand.pdf [2010, May 21]

[8] Ministry of Public Health. Thailand Health Profile 2005 – 2007. [Online]. 2007. Available from: http://www.moph.go.th/ops/health_50/4_3_ENG.pdf., [2011, July 5]

competition from countries with cheap labour.[9] Moreover, changes and advances in technology are also an important factor since the technology is conducive to increased productivity in agriculture and the driving force of the industrial revolution and value-added in production of goods and services. Hence, higher education also helps building knowledge to support and enhance effectiveness of labour market in those sectors. Thus, it's important to enhance research and development that may affect the survival of Thai industries in the future.

3. Role of university in enhancing competitiveness capacity

Thailand needs to develop the capacity of research in institution to create and integrate knowledge for academic excellence. The role of higher education institution especially, university should be strengthen research activities to be more effectiveness by explicit direction, specific excellence and the compilation of research collaboration and resource. However, the competitiveness of Thai universities could not equivalent to regional or global universities. The capacity of innovation creation is low and the basic science infrastructure is in low level which reflected from the number of researcher, publication, and patent including the government investment in R&D.

Before the Asian Economic crisis, Thailand's economy expanded rapidly. However, the expansion was not aligned with productivity gains because investments in research and development (R&D) and human resource development in Science and Technology (S&T) are insufficient thus, the economy growth capability decreased and became weak. The government tried to accelerate the R&D capacity and human resource development in S&T and higher education is seen as a key factor for the success of national and establish economy's sustainable growth. The government attempted to diversify institution into research universities in order to guarantee institutions' qualities of in higher education system.

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[9] Office of National Economic and Social Development Board and World Bank. Towards a Knowledge-Based Economy in Thailand. [Online]. 2007. Available from: http://siteresources.worldbank.org/INTTHAILAND/Resources/333200-1130224663121/2008feb-ke-thailand.pdf [2010, May 21]

The First National Economic Development Plan which, was made in 1959, emphasized the need of research of the country.[10] The National Research Council was established to make plan and introduce support for research. University teachers and government departments were received grants through the Council. However, the amount of fund was only a small fraction. Nonetheless, there was attempt to accelerate research university in early 1970. Research institutes were established inside universities and government departments. The criteria for academic promotion was include research publications. The aims of universities then included research for the knowledge production and as educational tool, particularly for the expanding graduate education. Some universities set the research universities as their goal.

In 1993, the Thailand Research Promotion Fund was established and was given budget to promote research. However, Thailand has fallen substantially beside other countries in R&D. While developed countries and major growing economies in Asia invested 1-3 percent of GDP in R&D, Thailand invested only 1.12 percent in 1996.[11] The government's plan to increase R&D investment has been constrained by the limited capacity of academic and research institutions and industry to absorb such investment and undertake R&D.

The Eight National Economic and Social Development Plan (1996-2001), which was evaluated midstream in the wake of economic crisis, continues to accord high priority to the promotion of Thailand competitiveness in the world economy, In recognizing the limited capacity of postgraduate education and research. The Eighth plan aimed to envisage an increase in government support for R&D for R&D to catalyze the country R&D investment. Moreover, the government recognized that greater institutional autonomy is a key to successful higher education reform, especially to diversify resources and enhance their efficient use.

A recent study revealed that Thailand's incremental capital to output ratio rose from 3.1 during 1985-1990 to 5.1 during 1990-1666, while growth rate decline from 10.3 to 8.0 percent during these two periods. This showed that

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10 Charas Suwanwela. Higher Education Reform in Thailand. [Online]. 2010. Available from: http://www.international.ac.uk/resources/Higher%20Education%20Reform%20-%20Thailand.pdf, [2011, July 5]

11 United Nations. World Economic Situations and Prospects 2008. New York, 2008.

Thailand need higher levels of investment to overcome the decline and achieve high growth rates. Thailand's development of appropriate human resources had not kept pace with the demands of economic undergoing structural transformation, especially, in the rise of increase globalization. The failure of public policies to promote the right skills and to foster R&D collaboration between the private and public sectors, including the universities, has contributed to the erosion of Thai competitiveness, and consequently, to the financial crisis. Moreover, Thailand's rapid economic expansion has intensified the country human resources bottleneck; the missed opportunities in developing its human capital for technological advancement with now further aggravate the project shortage of scientists and engineers. The strong demand of S&T human resources has also resulted in increase in the real wages of scientists and engineers, and consequently the inevitable drain off high quality staff from the public to private sectors as wage differentials between two sectors become more pronounced.

To restore its competitiveness in the world economy, Thailand needs to increase its productivity by upgrading S&T skills and investing in R&D. Although the share of the Thai private sector spending in total R&D expenditures has increased from 6.8 percent in 1987 to 10.8 percent in 1996. R&D investments are still low by international standards. Thus, there the continuing need for the government to lead investment in R&D. In addition, the government needs to harness the potential of R&D universities as the center for developing human resources and to foster its closer collaboration with the productive sectors. Considering the possible multiplier effect of R&D investment in universities by improving industry-university cooperation and producing a larger supply of scientists and engineers, the development of postgraduate's education and research should be accord high priority.

Higher education management system has been transferred the administrative authority from Office of Higher Education Commission (OHEC) to institutional level. Ministry of Education, Ministry of University Affair and National Education Council, which were the three main agencies involved to national education, were merged to established the new ministry of Education in 2003. The amalgamation was a consequence of National Education Act (1999) and the bureaucratic reform in Thailand. The reform also influenced on higher education

institutions, particularly, governance and university personnel management. OHEC launched two higher education policies 1) the strategic plan for higher education quality development to produce good quality graduates and researchers who will contribute to the social and quality development, which is a major objective 2) the Second 15-Year Long Rang on Higher Education (2008-2022) for national roadmap framework on higher education

The strategic plan for higher education quality development has been compelled during 2005 – 2008. To produce good quality graduates and researchers who will contribute to the country social and economic development is the major objective. It focused on enhancement of higher education in four aspects namely: 1) graduates' quality 2) faculty members' quality 3) researchers' quality and, 4) quality of education provision.[12]

Thai higher education system had been categorized and designed into four sub-systems to reflect ambitions and strengths of higher education institutions namely: 1) Research and postgraduate universities 2) Specialized including science and technology and comprehensive universities 3) Four-year universities and liberal arts colleges 4) Community colleges. Each sub-system would serve national preferences and strategies as well as respond to global national, regional, and local demands with the goal to improve competitiveness of the country, and to serve as major driver for the development of real sector manpower, manufacturing and service sectors. The long-term goals of the plan intended to decentralize the governance, continuing and lifelong education, social and economic improvement of productivity, and right down to equipping migrant workers requisite skills and knowledge.

In October 2009, OHEC has selected 9 public universities to support and upgrade them as national research universities namely: 1) Chulalongkorn University 2) Thammasat University 3) Mahidol University 4) Kasetsart University 5) King

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[12] Office of the Higher Education Commission. Thai Higher Education Policy and Issue.[Online] 2010. Available from: http://www.inter.mua.go.th/main2/files/file/Plicy&Issue/OHEC%20Policy&IssueThai%20 Higher %20Education%20PolicyIssue.pdf [2011 July 26]

Mongkut's University of Technology Thonburi 6) Chiang Mai University 7) Khon Kaen University 8) Suranaree University of Technology and, 9) Prince of Songkla University. The government will provide additional funding to full fill research capacity of 9 national universities. The objective of categorizing national research capability is to produce research outputs and manpower in advance fields of study that could serve the community and national demands real sectors, including enhance the country's competitiveness; create new body of knowledge and innovation that could contribute to social economic development, and improve the quality of life as well as to promote the country to be a regional education center.

2. National research universities' significance

Research capability of the nation is a key factor to produce high quality human resources and researches which lead to global competitiveness and sustainable development. The Institute for Management Development (IMD) indicated that Thailand should improve research as follows:

1) Increasing more R&D investment

2) Increasing quantity and quality of personnel

3) Encouraging private sectors to participate in R&D

In Thailand, university is still a largest unit for producing research outputs and researchers. The number of international research indicator from Scopus showed that 90% of research outputs came from universities especially, top universities of the nation. In 2008, there were 25 universities from ASEAN were ranked in top 500 World University ranking by Times Higher Education-QS (7 Thai universities, 2 Singapore universities, 5 Malaysian Universities, 4 Malaysian Universities and 7 Indonesian Universities). Malaysia could develop 5 research universities to rank in ranked in top 500 World University ranking as follows: Universiti Malaysia, Universiti Kabangsaan Malalysia, Universiti Sains Malaysia, Universiti Putra

Malaysia and Universiti Teknologi Malaysia.[13] It could be said that Malaysia is another country besides Singapore which enthusiastically promotes research university to evaluate in World University ranking during past 3-5 years. Thus, the government appreciated the important of research achievement and assigned OHEC an urgent policy to upgrade research universities to world-class universities and supported Thailand to become center of education, R&D and training/national research conference in regional level. This policy is consistent to Second 15-Year Long Range Plan on Higher Education (2008-2022) which aimed to improve research university to world-class level and become regional education hub. To achieve these objectives, it is necessary to increase the number of R&D indicator by great leap forwarding. Meanwhile, research universities should participate in solving national problems by conducting research about production sector and society problem including upgrade research in higher education institution level. Hence, National Research University project is developed to respond to government policy in education development to excellence and national problem solving which lead to higher education promotion and support national competitive capacity of the nation.

2.1 Background

The Thai government has issued a policy to upgrade research universities in Thailand as National Research Universities and upgrade them to international standard. The government intended to promote as educational research and development, and academic conference hub of the region. The OHEC has therefore started to implement National Research University and Research Promotion in Higher Education Project with financial support under the Stimulus Package 2 Plan and invested a total budget of 12 million baht for execute the project. The period of the project is 3 years (2010-2012) to improve research capacity, develop research among universities research and enhance research capacities in all universities.

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[13] Office of the Higher Education Commission. Thailand's National Research Universities. Bangkok : Amarin Printing and Publishing Public Company Limited, 2010.

2.2 Vision

1. Developing national research universities to become World-Class Universities which Thai context and identity.

2. Becoming base of production sector, economy and society of country.

3. Upgrading higher education quality in all levels to become regional education hub and enhancing more competitive capability.

2.3 Objectives

1. Upgrading research potential of universities in general and promoting universities with research capabilities to become national research universities which can compete with World-Class University.

2. Producing human resources in various fields to respond to demand of community, industry, and innovation system which lead to enhance competitive capability.

3. Developing Thailand to regional education hub.

2.4 Goals

1. Establishing 7-10 national research universities with world-class potential in Thailand to increase competitive capability and encourage producing high quality graduate students and categorize universities into four sub-systems as follows:

- Research and postgraduate universities to increase nation's competitive capabilities.

- Specialized including science and technology and comprehensive universities to enhance productive capacity for industries and production sectors.

- Four-year universities and liberal arts colleges to expand production and regional business to drive regional revolution.

- Community colleges to enhance strength of community and develop regional workforce

2 Establishing research groups which can produce international publications which applicative for production sectors and promote high technology investment, distribute income to community, support industry and substitution import.

3. Establish 7-10 national research universities and at least 30 international research network centers.

4. Allocating 2,500 researches funding within 3 years.

5. Increasing 6,000 international research outputs within 3 years.

2.5 Inputs

Inputs are National research university funding and rules of the program to complete missions and goals. The rules are reflected in strategy, unit of support, selection criteria, evaluation criteria, and other operational mechanisms.

1. Scope and procedure

This project is under board of directors and working groups committee which were appointed by minister of ministry of education. It aims to develop national research university and nurture research in higher education level by selecting 7-10 potential and meet criteria universities then improving them to national research university.

- Concept of improving Thai universities to national research university. Using university ranking by THE-QS (Considering from publications in Scopus) which categorizes into 5 fields: Arts & Humanities, Social Sciences, Technology, Life Sciences & Biomedicine and, Natural Sciences. The strategy of national research university development will be a mechanism to drive university in target groups solve research problems with explicit roadmap and independently administrate internal sectors and potentially identify direction and identity of national research universities. Moreover, creating flexible scholarship allocation system to increase operation confidence and lead to universality.

- Operation Plans. To accelerate this project along with government policy, OHEC prepared selection plan and announced selected university in July 2009

2. Application requirement for funding -

2.1 The university must appear not less than 500th rank in THE-QS ranking in annual 2008

2.2 In case the university does not appear in the ranking, the university must have these portfolios.

- Not less than 500 research outputs in international database (Scopus) in latest year.

- Internationally produced remarkable research outputs at least 2 of 5 fields in THE-QS

- More that 40% professors with doctoral degree.

2.3 Be able to identify direction and identity of national research university.

2.4 The information in university website must be qualified and up-to-date in OHEC database.

3. Selection criteria

The university must create strategy, objective plan and budget plan which is consistent to project's vision to drive the following outcomes;

3.1 Reach the top 400 ranking (for less than 400th rank universities) or reach better rank (for universities which are ranked higher than 400) in THE-QS ranking both general and specific fields (Arts & Humanities, Social Sciences, Technology, Life Sciences & Biomedicine and, Natural Sciences)

3.2 Establish at least 3 research groups/centers in national or international level and the outcomes can specify that the capacity of group/center is number one in the nation and produce researches which are excellence in international level and link to industry sector and.

3.3 Continuously hold international conference in proficient areas and increase the number of foreign student, foreign professor and international program.

4. Budget allocation

The selected universities will receive budget support. The consideration are making by criterions as follows;

- KPI and research capacities in last 5 years = 15%
- Research outputs efficiency in last 5 years (Slope) = 15%
- Strategy and roadmap to higher level in THE-QS and challenge to produce outputs according to project-proposal = 70%

It expected that each national research universities will receive budget about 100-500 million bath per year for 3 years. The financial amount for improving national research universities is about 9,450 million baht. The amount is allocated for research infrastructure, research fund, honor professor fund, and pattern development and administration of national research universities.

5. Criteria for monitoring and maintaining national research university

- Produce outputs and use of fund is based on selection. The universities which are in THE-QS must get higher rank by focusing on impact factor and evaluating on indentified KPI and social impact.
- The universities which are not ranked in THE-QS will be evaluate according to proposed KPI. If the universities are selected, it considered as success.
- The evaluation emphasizes on up-to-date database system in OHEC and database and university's website.
- If the universities can not achieve goals, the education durable articles which are purchase during participate in the project must be return in mint condition to OHEC to transfer to better potential universities and can not participate in this project for 3 years.

6. Quality indicator of world-class university

The indicator is referred from Times Higher Education in 2008 integrated with Thai context indicators. The criteria and value as follow; research quality (60%), teaching quality (20%), international outlook (10%), graduate employability (10%)

7. Research promotion in higher education

7.1 Concept of research promotion in higher education

- Use research funding as instrument to drive Thai higher education into 15-Year Long Range Plan on Higher Education's direction particularly, categorizing 4 group universities.

- Research funding allocation system which is consistent with personnel working age and be able to enhance research capacities of professors and staffs in various dimensions.

- Use openness and competitive research funding allocation system to enhance equally access to grant resources from public and private sectors.

- Use management innovation and monitor achievement of all research grants.

7.2 Enhance research quality in higher education strategy and categories of research scholarship

- Build motivation for professors by allocating comprehensive research funding which are consistent with professors' career path as follows; grants for production of PhD, grants for development of new faculty staff, grants for development mid-career researcher/professor, post-graduate fellowship, post-doctoral fellowship and research cluster development fund.

- Use research grants as instrument to drive university categorize as follows; grants for identity development especially, new research university groups, research capacity building fund for new university groups, research grants for academic staff and grants for enhancing professional capacity of personnel.

7.3 Approach to research fund allocation

Give various research grants to improve professor and personnel to become researcher development. The term of project is 3 years (2010-2012). The total budget is 2,753 million baths and allocate into major scholarship as mention above.

8. Budget

The budget for carry out the project is 12,202 million baht in total for 3 years (2010-2012) as follow;

Table 8: Estimate of the budget of Higher Education Research Promotion and National Research University Project

Approach of Investment	2010	2011	2012	Total
1. National research university fund	3,150	3,150	3,150	9,450
2. Higher education research fund: professor and personnel in higher education institutions	404	953	1,395	2,752
Total	**3,554**	**4,103**	**4,545**	**12,202**

2.5 Expected outcomes

1. 7-10 National research universities get higher rank in World University Ranking (THE-QS) and are accepted from various nations.

2. Strengthen higher education was accepted as "ASEAN Education Hub" and become center of education, research, conference/seminar, training in international level to expand income to nation from academic activities.

3. The research outputs help expanding income to community, industry, export support, and import substitution.

4. Categorize university into 4 groups and provide specialist professor in producing graduate and research outputs which are consistent with each group missions.

5. Thai university distinctly influences on enhancing competitive capacity of each nation.

CHAPTER V
ANALYSIS OF RESEARCH FINDINGS AND DISCUSSIONS

5.1 Brain Korea 21's effects on higher education

Table 9: List of Korean informants

Name	Workplace	Position
Mr. Han Min-Koo	College of Engineering/ Seoul National University	Program Chairman of Brain Korea 21
Mr. Kim Young-Jin	Ministry of Science, Education and Technology	Korea Oversea Department Official

The informants expressed that the major influence of BK21 on higher education is to boost research outputs. Seeing from rapid increase in the number of SCI papers, the growth rate of science and engineering research groups was 12.8 percent which exceed the 11.5 percent growth for all universities. SCI papers for doctoral researchers and research professors had increased by 33 percent and 32 percent for graduate student during the Phase I. Many science and engineering research groups in Phase I were comparable to benchmark university in number of SCI papers per faculty member. In addition, the program motivates competition among universities and faculty members increased number of teachers, research assistants, post-doctoral and contact-based researchers. Graduate students have more confidence to compete internationally and that international exchanges improved the quality of research and education in the recipient graduate department. Moreover, Brain Korea has contributed to linkage between university and industry. The number of patents also increased because BK21 has demanded university to increase cooperate between university and industry. The project has evaluated the cooperation so, many universities participated in university produce lot of patents.

One of the interviewees emphasized that allowances for graduate students, post-doctoral researchers and research professors are the main incentives of BK21. It decreases the expected cost of obtaining doctoral and master's degree. They were pursued to further an advanced degree and induce recipients to devote more time to

producing research. The program provides free manpower for faculty to use in their research activities. The interviewee also told that BK21 provides stable financial incentive so, the recipients can spend more time on research and R&D capabilities of participated university such as, Seoul National University (SNU), increase very much, especially in international level.

Therefore, BK21 subsidizes or decreases university R&D cost. BK21 funding also expands job opportunities for postdoctoral researchers and young researchers because the departments have to recruit more post-doctoral scholar and researchers faculty with better research capability to take advantage of BK21 funding as well. The institutions need to enlarge the number of researchers to increase competitive capacities with domestic and foreign institutions.

Not only recipient universities, but also non-recipient universities whom BK21 has changed the activities. Non-recipient of Phase I made extreme efforts to enhance their research productivity so that they could be qualified for Phase II due to the following reasons: the universities receives BK21 funding can attract high quality students or recruit as many as they can, and most Korean universities depend heavily on tuition as their revenue source and usually lack the financial resources for scholarship and allowances for graduate students.

However, there are still some points which needed to improve in BK21 project. Too much emphasizing of research effects teaching to be neglect and, even though the project increased the quantity of research but, not include their quality. For example, the interviewee indicated that SNU has greater research ability than other universities after joined in the program but, it focused too much on evaluation and quantity of paper. It could see that very few Korean researchers published their outputs in top science journals. Moreover, during the first phase one, the number of BK21 program coming from the metropolitan area, it took up 65 percent of the whole grant for science and technology fields and 96 percent of humanities and social science fields so it has brought about the wider gap between universities in Seoul metropolitan and other regions. Therefore, the phase II was initiated to continue the success of phase I, including to improve the weakness of the project such as establishing regional graduate schools of excellence to decrease the gap of research capacity between metropolitan and regional universities.

Brian Korea 21 project affects the incentives, output and outcomes of research as follows;

Incentives and activities of research. The main incentives of BK21 are allowances for graduate students, post-doctoral researchers and research professors. BK21 funding decreases the expected cost of obtaining doctoral and master's degree and induces recipients to devote more time to producing research by providing an incentive to pursue an advanced degree. The project provides free manpower for faculty to use in their research activities. Therefore, BK21 subsidizes or decreases university R&D cost. Moreover, BK21 is a very attractive financial opportunity for academic departments and universities because the award is sizable and stable over time. Departments have to recruit more faculty members with better research to establish incentive systems that reward faculty members with higher research productivity. Departments have to hire more post-doctoral scholar and researchers to distribute more to take advantage of BK21 funding as well.

BK21 project changes the activities not only recipient universities, but also non-recipient universities. Non-recipient of Phase I tried to enhance their research productivity so that they could be qualified for Phase II Not only recipient universities, but also non-recipient universities, BK21 has changed the activities. Non-recipient of Phase I made extreme efforts to enhance their research productivity so that they could be qualified for Phase II because most Korean universities depend on tuition as their revenue source and usually lack the financial resources for scholarship and allowances for graduate students so, the universities receives BK21 funding can attract high quality students or recruit as many as they can. However, BK21 has increased the emphasis on research and decreased the emphasis on research.

Outputs and outcomes. Research outputs come from BK21 project changes in quantity, as seen by the number of doctoral and master degree holders, or in quality, as seen by recipients' publications. The research capabilities of faculty and graduate students have essentially improved because of the program's contribution to funding and the competition among universities and faculty members. The number of paper recorded in the SCI was a main evaluation in the BK21 screening process. Not only universities participating but also those trying to improve their position to

compete for funding. Therefore, BK21 was a publication drive comparable to the export drive economic growth during Korea's development era.

Another output of BK21 is that the project created a competitive environment both within and among universities. For example, receiving BK21 funding will attract high quality graduate students. Even universities which have enough funding still want to participate in the project to receive such advantages. Universities which failed to obtain funding in Phase I reformed their institutional structure by increasing recognition of the important of top talent and lower decrease tolerance for ordinary performers. Some university offers bonuses to professors who published in top journals and had also established a special scouting fund to recruit top professors by paying higher salary. These universities also hire more postdoctoral researchers to increase the number of publications produced by their institutions.

One of the informants indicated that Korea government has lots of effort to increase cooperation between university and company by support and invest in research conducted by university and company. Moreover, the government tries to overcome job skill mismatch in Korea by support universities to respond to company demand such as reorganizing curriculum or department to align with companies' needs. BK21 has demanded university to increase cooperate between university and industry so, many universities participated in university produce lot of patents.

For human resource development, the one of the interviewees said there were around 25,000 professors and 53,000 master degree students who participated in the project. The number of SCI publication of professors in the project has increased, for example in 3,765 in 1998 to 7,947 in 2005. In terms of quality, the impact factors of professors who participated in the project have also improves for instance in 1.68 in 1999 to 2.28 in 2005. Thus, BK21 not only increase the number of PhD and research but, and skills and capability as well.

Outcomes include both the intended and unintended long-term impacts of the program. They may include international prestige of Korean universities in particular and of higher education more generally, as well as effects on labor productivity and workforce skills. These may be affected not only by BK21 but also by efforts made by other universities and broader financial and S&T trends in the rest of the world that affect academic and professional opportunities. Causality between

program inputs and outcomes may not therefore be as direct as that between inputs and outputs of the program. The true effect of BK21 in improving the size and quality of the pool of knowledge workers in Korea and increase in Korean universities with international prestige will only occur over time. Perceived excellence (prestige) as well as de facto excellence matters to top international universities. The number of published papers in top journals is an indicator of de facto academic excellence, but it does not necessarily bring prestige in the short run. Pursuit of prestige involves a large scale investment for a long time. Our respondents said BK21 has had some success in improving the stature of Korean universities, but lacks the resources to achieve some of its workforce goals. The representative of the university winning both Phase I and Phase II funding said students now perceive its science and engineering schools to be competitive with the top 25 to 30 universities in the United States. He also contended that the engineering school, especially, is competitive with that of Tokyo University, although Tokyo produces more publications because of its larger faculty (about twice that for his university) and the greater emphasis SCI places on Japanese-language journals. Regarding the Phase II goal of nurturing manpower that can create new technology, one respondent said that BK21 does not have a mechanism to improve the mismatch between the supply and demand for scientists and engineers. BK21 selection and evaluation criteria do not address employment balance for the S&T workforce. However, MoE officials said the Phase II program intends to improve the mismatch by introducing a new academic panel for “interdisciplinary fields in science” and by generally promoting university-industry collaboration.

5.2 Brain Korea 21’s future perspective

From the analysis mentioned above, BK21 aims to develop human resource, particularly at the graduate and young research more than the infrastructure which is necessary for research conducting. The main idea is that aiming the critical element of R&D manpower development will affect overall shift in R&D capacity of Korea’s universities and institutes. Moreover, this will lead to positive changes in economic and social well-being of the country. The interviewee indicated that most universities participants in Phase I gain the instructure for Phase I. Thus, the predict for the future program are as follows:

1. Increase Korea's research manpower pool. BK21 helps to increase the size of the pool of trained research workers in Korea by increasing the production and retention of such workers. The project seeks to increase the size and the quality of the domestic pool of knowledge workers. Furthermore, those who pursue their professional careers aboard may return because they see Korea more attractive for knowledge and creation.

2. Enhance high quality globally competitive research. The universities participating in BK21 will compete with each other to become winner of the program to attract high quality student and to receive the advantage in applying to other education-related project in the future. Those universities will recruit high quality professors and researchers to increase capability of the university both domestically and internationally.

3. Encourage university reform. University have to adopted a performance-based promotion system and structural reform, such as downsizing or closing weak department and encouraging weak faculty members to leave the university to increase academic competition between university, including those not gaining funding but seeking to do so in the future round.

4. Motivate university-industry collaboration. BK21 will continue to enhance the communication and partnership between researcher and partnership in private firm and Korean universities. These formal and informal partnerships would not only enhance the degree of support that industrial firms inside and outside the Seoul area may derive from academic research activities but would also provide another source by which universities and research departments at regional universities could become fuller participants in innovative activities at higher level of competence. This is part of a strategy to enhance the standing of Korean university internationally and of regional universities within Korea.

In conclusion, BK21 project is Korea's endeavor to reform university to nurture high quality graduate students and researchers which are Korea human resources for a knowledge-based economy in the 21st century. It helps to create academic atmospheres of universities and producing prominent outcomes. In other

words, BK21 project help to build Korea's world-class research universities in the future.

5.3 Brain Korea 21 SWOT Analysis

Analyses of internal and external factors of BK21 are strengths, weaknesses, opportunities and threats as indicated in table 10.

Table 10: Brain Korea 21 SWOT Analysis

	Positive	**Negative**
Internal Factors	**Strengths**	**Weaknesses**
	- Long-term project - Large Funding - High competition for funding	- Teaching was neglected
External Factors	**Opportunities**	**Threats**
	- Global universities have become the criterion for estimating a country's competitiveness - Globalization made innovation is more market-driven than in the past and stronger competitive pressures push firms to become more innovation and to rapidly adopt recent technology. - Government support knowledge-based economy and lifelong learning	- Overheat competition for entering top-higher university - Non-selected universities may loose their students

5.3.1. Strengths.

- BK21 is a long-term project. The time period is seven years so, the funding is stable for long periods. Thus, the recipients could consecutively conduct research without worry about subsidy.

- Compare with other project-based research funding programs, BK21 award for an individual group is larger. For example, annual average funding for a science and engineering research group was 1.77 billion KRW (maximum award was 6.82 billion KRW and a minimum was 0.38 billion KRW) during Phase I. in the Phase II, annual funding programs for a science and engineering research group is between 1.5 billion and 7 billion KRW, while other project-based research funding to universities is quite small. For instance, the KRF's Basic Research Program in 2005 average funding was less than 0.1 billion KRW per project. Moreover, BK21 can be regarded as an important portion of total educational fund supporting the research in a few groups of selected recipient universities.

- The competition rule, which based on ranking of universities, persuaded stronger competition among department and universities than before. Selection criteria are announced before the selection process starts so that application may estimate their expected ranking. Research groups are ranked within each academic discipline and ranking criteria are weighted differently for different groups. Each group winning funding receives the amount it requested as long as it meets general guidelines on distribution and the total amount requested by all groups in each academic panel is within the range of pre-announced funding. BK21 award size is basically proportional to department size.

5.3.2 Weakness

- Even though research emphasis has increased but, the teaching was deceased because professor wanted to produce many papers as possible.

5.3.3 Opportunities

- Globalization made innovation is more market-driven than in the past and stronger competitive pressures push firms to become more innovation and to rapidly adopt recent technology. R&D is very important key to enhance firms' competitiveness. Thus, BK21 project helps to foster researchers who will become main power to produce researches for creative knowledge and innovation in the future.

- Global universities have become the criterion for estimating a country's competitiveness in knowledge-base economy. BK21 project support master

and doctoral program students and young researchers to nurture a research-centered university with global competitiveness and become the key national growth strategy.

- Government support knowledge-based economy and lifelong learning

5.3.4 Threats

- Overheat competition for entering top-higher university because those universities have many high quality students and researchers and have more chance to be selected by BK21 funding. Universities awarded by BK21 will receive enough funds to support their graduate students and will have great advantage to attract high quality students to their programs

- Non-selected universities may loose students which increase a gap between selected and non-selected universities.

From BK21 SWOT analysis above, it could lead to understand the project strategy as indicated in table 11.

Table 11: BK21 TOWS Matrix Analysis

Internal Factors External Factors	Internal Strengths - Long-term project - Large Funding - High competition for funding	Internal Weaknesses - Teaching was neglect
External Opportunities - Global universities have become the criterion for estimating a country's competitiveness - Globalization made innovation is more market-driven than in the past and stronger competitive	SO: - Nurture top-class expert in technologies with high capability for growth in the future. - Strengthen industry-academia corporation - Further develop research-oriented with global	WO: - Simultaneously support teaching and research to enhance university competitiveness

pressures push firms to become more innovation and to rapidly adopt recent technology. - Government support knowledge-based economy and lifelong learning	competitiveness	
External Threats - Overheat competition for entering top-higher university - Non-selected universities may loose their students	ST: - Encourage highly qualified regional high school graduates to enter the regional university - Facilitate the regional university graduate students' advanced study.	WT: - Make sure that the selected universities make improvements.

Firstly, the SO strategy (strengths-opportunities strategy) involves making use of strengths to develop world-class expert groups by nurturing top-class expert in technologies with high capability for growth in the future, strengthening industry-academia corporation and further develop research-oriented with global competitiveness.

Secondly, the ST strategy (strengths-threats strategy) involves using the strengths of BK21 to minimize environmental threats. Encouraging highly qualified regional school graduates to enter the regional university and facilitating the regional university graduate students' advanced study will decrease overheat competition for entering top-higher university and protect non-selected universities to lose their students.

Thirdly, the WO (weaknesses-opportunities strategy) involves overcoming the weakness of BK21 to make use of environmental opportunities. Globalization made innovation is more market-driven than in the past and stronger competitive pressures

push firms to become more innovation and to rapidly adopt recent technology and global universities have become the criterion for estimating a country's competitiveness. However, the teaching was neglect because students and professors try to produce more research as possible. Therefore, simultaneously support teaching and research would better increase competitiveness of universities.

Finally, the WT (weaknesses and threats) strategy involves minimizing the environmental threats and the weakness of BK21. Overheat competition for entering top-higher university may lead the non-recipient to lose their students. Thus, it needs to make sure that selected universities make improvements.

5.4 National Research Universities' effects on higher education

Table 12: List of Thai informants

Name	Workplace	Position
Associate Professor Dr. Amorn Petsom.	Chulalongkorn University	Director, Institute of Biotechnology and genetic Engineering,
Professor Dr. Sansanee C. Chaiyaroj Ms. Ratana Petchurai	Mahidol University Mahidol University	Vice President for Research and Academic Affair Director of Division of Research Administration
Associate Professor Dr. Sornprad Tanaisawanyangkul	Kasetsart University	Vice President
Dr. Raktipong Sahamitmongkol	Thammasat University	Researcher

The informants indicated that before the National Research University Project was initiated, the universities have policy to stimulate and support research activities by establishing center of excellence, clusters, or research institutions to enhance

research capacity. These institutes help to destroy the barrier between faculties and internal institutes. For instance, social institution might conduct research in collaborate with medical institution. It leads to research integration. Therefore, the project helps to stimulate more attentiveness of research production in universities which were selected to participate in the project. Observing from the number of research proposals were submitted from researchers who want to participate in the project. The allowances have been allocated to students, professors and researchers to support their research activities and help to increase research environment as well.

The non-recipient universities were also supported by the government. Those will receive funding for the promotion of university research following guidelines specify in the Second 15-Year Plan on Higher Education that classified universities into 4 groups categories.

For monitoring and maintaining national research universities, the informant indicated that they will measure from academic excellences which are number of publications, number of patents, number of graduates, and products. This contributes to stimulate research outputs and activities in universities.

Thailand's National Research University project affects the incentives, output and outcomes of research as follows;

Incentives and activities of research. The main incentives of NRUs are budget for research infrastructure and research funds for graduate students, post-doctoral researchers and research professors. Particularly, open competitive research grants which allow access to research funding for researchers from different fields. It could be said that NRUs' funding provides another sources to support research activities in universities. For activities of research, development of National Research Universities and Promotion of national research are two main activities to solve country's problems.

Outputs and outcomes. Outputs are research product from NRUs project which each university promised to submit when the project ended. Output might change in quantity, as seen by the number of doctoral and master degree holders, publications, patents, etc. It could be said that NRU's project is another publication drive program for Thailand as well. For quality, the impact factor and the number of publications which were published in top journals are increase. Another

output of NRUs is that the project increases a research environment both within universities. For human resource development, the one of the interviewees said the number of master degree students who respond to labour market needs are increasing. For outcomes, there will be national research universities occur in Thailand and help to upgrade universities ranking in the future. Moreover, the project helps to improve the size and quality of the pool of knowledge workers. The university-industry link output and outcome are still indistinct because the project has started only one year. Anyway, NRUs will produce patents and product as identifies in proposal thus, the collaboration between university and industry link will increase in the future.

However, the indicated that the outcomes from the project cannot meet the objectives because of following reasons;

1. The budget of NRUs was delay and continuously cut which cause burden to the universities.

2. The overall budget is not enough to increase R&D capacity of the country.

2. The reducing of budget over time and decreases researchers' expectations and expeditions and lead to decline the incentive to produce research as defined in the scope and procedure of the project as they should.

3. Five universities are autonomous university and four universities are public university which the administration systems are different. This affected the easiness of budget disbursement of public university because the disbursement must follow the regulation of the Comptroller General's department on specific grant disbursement. Thus, those universities couldn't receive budget immediately.

Each university tries to solve those problems mentioned above. Chulalongkorn University (CU) authorize Chula Unisearch to administrate and monitor the progress of NRU Project because NRU Project is a large project, which have 144 projects under, and involve many research groups and use large funding so, the number of CU's staff of academic affaire is insufficient. Unisearch take care of administration, disbursement of funding, document related to NRU and monitor the progress of the project. Therefore, CU can efficiently manage the project and decrease the problems about funding disbursement of researcher under the NRU project.

5.5 National Research Universities SWOT Analysis

Analyses of internal and external factors of NRUs are strengths, weaknesses, opportunities and threats as shown in table 13.

Table 13: National Research Universities SWOT Analysis

	Positive	**Negative**
	Strengths	**Weaknesses**
Internal Factors	- Enhance more research collaboration - Destroy the barrier between faculties and internal institutes	- Short-term project
	Opportunities	**Threats**
External Factors	- Knowledge becomes key strategy for economic development - Government support human resource with research skill	- The government decreases overall R&D budget - Rising competitiveness universities of neighboring countries

5.5.1 Strengths

- The collaboration within research institutes helps to enhance competitiveness and the strength of innovation system of institute. Research collaboration will leads to technology transfer and knowledge sharing to increase research outputs. Lone & Clark (2002) asserted the benefits of research collaboration as follows;

1) Collaboration strengthens use of individual's talent.

2) Transfer of knowledge or skills

3) Collaboration is a source of stimulation and creativity

4) Provides intellectual companionship

5) Extends researchers' networks

6) Enhances disseminations of projects

- NRUs destroy the barrier between faculties and internal institutes which leads to expansion of necessary range of skills, transfer new knowledge, the extended network and further productivity ensured.

5.5.2 Weakness

- The project period is too short. The development of National Research Universities requires consistency to support research efficiently.

- After the government announced the promotion of research in universities and national research universities project in the year 2009, research budget of higher education institutions and universities was dramatically cut off in the following year (2011). Finally the budget has been reduced from 12,000 million baths to 5,000 million baht for 3 years. This reduces confidence of researchers to project and the delay of the budget reduces researcher incentives to produce research as well.

- The different administration of selected universities. Five universities are autonomous university and four universities are public university. This leads to inconvenient and delay of budget disbursement.

5.5.3 Opportunities

- Knowledge becomes key strategy for economic development. The government began economic and social restructuring again with primarily aims to developing country, generate sustained prosperity and better distribute the benefits to the people, the added value creation from knowledge application has been raised as a fundamental part of the restructuring of the country's economic and social align with basic principles of creating an stability and sustainability economic principle, proactive social policy to create positive externalities and linked to the global and regional positioning.

- Government support human resource with research skill particularly in science and technology fields which are major conditions of success in develop country into knowledge-base economy and build capacity for global competitiveness. The assessment of economic development status and knowledge and capabilities in the areas of science and technology to access knowledge-based economy found that it is necessary to accelerate the development of innovation in science and technology.

information technology and telecommunications, environment and economic institutions. Thailand needs to develop human resources quality and research capability to enhance nation's competitiveness with other countries.

5.5.4 Threats

- The government decreases overall R&D budget. Thailand has invested in R&D with small budget. In the past, R&D expenditure accounted for only 0.3 percent of GDP (GDP), but now back down to 0.2 percent of GDP while the developed countries and countries in the region invested more than 3-5 percent of GDP.

- Rising competitiveness universities of neighboring countries such as Malaysia. The Malaysian government regards higher education as a major issue of the nation. The four main public universities, which are UM, USM, UKM (Universiti Kebangsasn Malaysia), and UPM (Universiti Putra Malaysia), have officially selected as research universities to support knowledge-base economy. Therefore, NRUs have to compete with other research universities to be education hub of ASEAN.

Analyses of internal and external factors of NRUs are strengths, weaknesses, opportunities and threats as indicated in table 14.

Table 14: NRUs TOWS Matrix Analysis

Internal Factors External Factors	Internal Strengths - Enhance more research collaboration - Destroy the barrier between faculties and internal institutes	Internal Weaknesses - Short-term project - The instability of budget. - The different administration of selected universities.
External Opportunities - Knowledge becomes key strategy for economic development. - Government support human resource with	SO: - Establish networking and linkages with the manufacturing sector - Build partnerships with universities and research	WO: - Extend project period - Authorize each university to allocate budget by themselves or improve budget disbursement

research skill	institutes both at home and abroad - Strengthen the university group	
External Threats - The government decreases overall R&D budget. - Rising competitiveness universities of neighboring countries	ST: - Enhance research collaboration among university in the project to compete with neighbor countries - Support research collaboration with universities of neighboring countries	WT: - Increase overall R&D budget - Allocate sufficient budget to support research in universities

Firstly, the SO strategy (strengths-opportunities strategy) involves making use of strengths to establish networking and linkages with the manufacturing sector, build partnerships with universities and research institutes both at home and abroad and strengthen the university group to enhance national security and sustainable know ledge base society.

Secondly, the ST strategy (strengths-threats strategy) involves using the strengths of NRUs to minimize environmental threats. Enhancing research collaboration among university among university in the project, and support research collaboration with universities of neighboring countries will increase capacity in competition with other countries.

Thirdly, the WO (weaknesses-opportunities strategy) involves overcoming the weakness of NRUs to make use of environmental opportunities. Extend project period helps to increase confidence to students and researchers that they could conduct their research until their project succeed. Moreover, authorize each university in the project to allocate budget by themselves or improve budget disbursement would help to increase the flexibility and decrease the delay of budget problem.

Finally, the WT (weaknesses and threats) strategy involves minimizing the environmental threats and the weakness of NRUs. Increase overall R&D budge and allocate sufficient budget to support research in universities will enhance capacity of the country to compete with universities of neighboring countries and attract more foreign student so that Thailand can be real education hub in the future.

5.6 Comparison between Brain Korea 21 and National Research Universities

The Brain Korea 21 and Thailand's National Research Universities are not much different in goals, input, activities, incentives, outputs and outcomes of the project as shown in table 15.

Table 15: Comparison between Brain Korea 21 and Thailand's National Research Universities

	Brain Korea 21	National Research Universities
Project Goals	1. Increase size and capacity of research manpower 2. Foster global competitive graduate schools	1. Support university with world class potential. 2. Establish 4 groups of university that produce graduates and researchers, and academic achievement.
Inputs	1. Rules 2. Funding	1. Rules 2. Funding
Activities	1. Research 2. Teaching	1. Development of National Research University 2. Promotion of research in university level
Incentives	1. Subsidize cost of university R&D 2. Lower cost of obtaining advance degree 3. Provide income stability for post-doc, contract	1. Budget for research infrastructure and research funds. 2. Open competitive research grants which allow access to research funding for researchers from different fields.

	researchers department and universities.	
Outputs	1. Research quality and quantity. 2. Human resource production 3. University-industry link 4. Competitive environment both within and between universities.	1. Research quality and quantity. 2. Human resource production 3. University-industry link 4. Collaboration environment both within and between universities.
Outcomes	1. National prestige and ranking. 2. Industrial research quantity and quality 3. Highly educate workforces	1. Achieve higher ranking in the World University Ranking 2. Graduate and research projects. 3. Productivity of research projects for industrial community.

Project goals. BK21's main goals are to increase size and capacity of research man power pool and foster global competitive graduate school. Research manpower and strengthening graduate schools are the main elements of the project. while NRUs' main goals are to support university with world-class potential and establish 4 groups of university that produce graduates, researchers, and academic achievement. The main elements for NRUs are to upgrade leading research university and establish groups of university. Regarding the relationship between the two goals, enhance high quality research capacity of universities' member such as graduates and researchers are the key goals of the two projects. However, NRU project emphasizes on increase world ranking of universities which were selected as National Research Universities when BK21 emphasizes on produce world class graduate school for developing Korea's human resources.

Inputs. BK21'and NRU project's inputs are rules and funding. BK21 provides stipends to graduate students, post-doctoral fellows, and contract-base

professors of research unit groups. BK21 funding is awarded to department-level research groups (Sa-up-ban) in a stable lump sum over seven-years periods. The funding mode of both Phase I and Phase II is the lump sum budget while NRUs is project-based funding. The rules of two projects are principle and regulations which reflects in program strategy and selection criteria. BK21 project's strategy is to pick winner and support on them while NRUs strategy is to allocate budget by considering on KPI, slope, and project proposal. The universities which receive high evaluation will receive high budget as well. BK21 selection criteria are research merit, training, links to industry, university reform and specialization, and, for regional university groups, regional development while NRUs selection criteria are world ranking in THE-QS, the number of research center groups and international conferences.

Activities. BK21 project BK21 has increased the emphasis on research but, decreased the emphasis on teaching while NRUs will select 7-10 potential research university and develop to national research university by nurturing research in university level.

Incentives. The major incentives of BK21 are allowances for graduate students, post-doctoral researchers and research professors. The project also provides income stability for post-doc, contract researchers department and universities. As a result, BK21 funding subsidizes or decreases university R&D cost by decreasing the expected cost of obtaining doctoral and master's degree and induces recipients to devote more time to producing research. The main incentives of NRUs are budget for research infrastructure and research funds for graduate students, post-doctoral researchers and research professors. The Open competitive research grants which allow access to research funding for researchers from different fields.

Outputs. The main outputs of BK21 and NRUs are research quality and quantity, human resource production university-industry link and research environment. These outcomes could seen from the increase numbers of graduate students, number of publications and patents, However, BK21 emphasizes on competitive environment within and between universities while collaboration environment within and between universities.

Outcomes. The universities which receives BK21 award will obtain national prestige and ranking. Moreover, industrial research quantity and quality also increase and the graduate students will become high skill workforce in the labour market. The outcomes of NRUs are Achieve higher ranking in the World University Ranking. The increasing of graduate and research projects and productivity of research projects for industrial community.

However, there are still some points which needed to improve in BK21 and NRUs project. BK21 has increased the emphasis on research but, decreased the emphasis on teaching. For NRUs, the budget was reduced over time which decreases researchers' expectations and expeditions which lead to decline the incentive to produce research as defined in the scope and procedure of the project as they should. Moreover, the administrations systems of universities participate in the project are different; five universities are autonomous university and four universities are public university and make the universities lack of flexibility in administration.

Table 16: SWOT Comparisons of Brain Korea 21 and Thailand's National Research Universities

Strengths	Korea	Thailand
	- Long-term project - Large funding - High competition for funding	. - Enhance more research collaboration - Destroy the barrier between faculties and internal institutes
Weaknesses	- Teaching was neglect	- Short-term project - The instability of budget. - The different administration of selected universities.
Opportunities	- Global universities have	- Knowledge becomes key

	become the criterion for estimating a country's competitiveness - Globalization made innovation is more market-driven than in the past and stronger competitive pressures push firms to become more innovation and to rapidly adopt recent technology.	strategy for economic development - Government support human resource with research skill
Threats	- Overheat competition for entering top-higher university - Non-selected universities may loose their students	- Competition with neighbors - Decrease of overall R&D budget

To analyze this topic, I will first synthesize the essential factors to establish World-Class Universities. Previous research indicated the strategies of new World-Class Universities as follows; [14]

- Government should upgrade a small number of existing universities which have high potential.
- Government should encourage a number of existing institutions to merge and transform into a new university.
- Government could create new institutions

It could be said that the role of government to establishing World-Class Universities are important factors. BK21 and NRUs project can be regarded as Korea and Thai government effort to upgrade existing universities with research potential to

14 Jamil Salmi. The Challenge of Establishing World Class Universities. Washington DC : The World Bank, 2009.

become World-Class Universities. However, NURs still lack behind Brain Korea 21 from the following reasons;

1. BK21 is long-term project (12 years) while NRUs is short-term project (3 years).The long-period of Brain Korea 21 helps to understand the process and problems of the project and the continuity of the project also helps to enhance incentives to conduct research among students and researchers in universities but, the short-period of NRUs might decrease the incentives of recipients because the most research projects need long time and effort to do so, they might lack of confidence that they will receive the support or fund until their research projects end or not.

2. BK21 Phase I (1999-2005) accounted 1 percent of R&D expenditures in Korea while Thailand spending 0.2 percent of GDP on R&D in 2010 which means the budget for NRUs project is very small compared with BK21.

3. BK21 project's budget is stable while NRUs budget is instable. Moreover, there were some researchers withdraw from the project. Moreover, some universities had to use their own budget prior to receive the fund from the project which cause burden to the universities and the researchers also lost confidence to the project.

Anyway, the advantage of NRUs is research collaboration. While BK21 enhance competition for funding which stimulates participants to strive for excellence, NRUs support collaboration between institution both within and among university which leads to technology transfer and knowledge sharing to increase research outputs. Therefore, NRUs will become the crucial resource of new knowledge creation for Thailand in the future.

CHAPTER VI
CONCLUSIONS AND SUGGESTIONS

6.1 Summary of Korea's human resource development and knowledge-led growth strategies

Education has been an important factor in Korea's rapid economic success. The government-led economic development plans has been directly reflected in education policy and planning. The government has been success in expanding the education system based on economic requirement. Thus, the education development system has aligned with economic development. The focus of the government's educational planning respectively moved from primary and secondary to higher education. Particularly, globalization increases the demands of high skills graduates and workforces to cope with knowledge-based economy.

Even though universities are the large pool of high quality human resources in Korea, most of R&D funded by government institutions and private companies. However, the universities play the crucial roles in supporting basic research and training potential researchers. Furthermore, increasing demands of knowledge-based economy in Korea raises the need for a national system as well. The cooperation between government research institutes, universities and private sectors become more important and the link between universities and industry expected to get stronger.

6.1.1 Korea and knowledge-based economy

Korea has been developing a foundation for knowledge-based economy after the financial crisis in 1998. Korea's economic development strategy focus on increasing the value added of product to achieve sustained productivity growth. Strengthening the capacity of human resources is necessary to enhance global competitiveness. Korea tried to establish modern infrastructure together with expansion of research and development capacities in Korean industries. According to World Bank, the four pillar of knowledge-based economy are as following; an economic incentive and institutional regime, an educated skilled and labour force, and effective innovation system and a modern adequate information infrastructure. Therefore, it could be said that education and human resources have been key factors in Korea's economic growth and transition to knowledge-based economy.

According to the interview, the driving force of education development came from high interest and passion for education of Korean people, national economic development strategy, education expansion which increases opportunity for education and nurturing and securing excellence teachers. After heavy investment in elementary education through the 1950s, middle schools received the majority of funds in the 1960s. Then with primary and middle school education widespread, the government of the 1970s responded with the expansion of high school education.

6.1.2 Outputs of Korea's higher education

1) The number of graduates of higher educational institutions both junior colleges and graduate school sharply increased from 33 thousand in 1970 to 570 thousand in 2007. Korean higher education institutions have nurtured and produced skilled people in various fields such as politics, economics, society, science, culture, and art. These people have become leaders in their areas and help to stimulate national development.

2) Korea has produced various educated people which have helped to create a lot of knowledge. The products of research are continuously increasing in Korea. The Science Citation Index shows that the number of research papers published by Koreans increased from 9,854 in 1998 to 25,494 in 2007 and Korea became 12th rank among 180 countries in this category. Accordingly, the share of Korean papers among globally published papers increased from 1.13% in 1998 to 2.17% in 2007.

6.1.3 Outcomes of Korea's higher education

1) The opportunities for higher education have expanded at the same time with the growth of higher education. The number of university students increased from only 7,800 at liberation to 3.56 million in 2008. The percentage of higher education students has reached 69.4% in 2007.

2) Higher education institutions produce, transfer, and apply knowledge activities which are critical to a knowledge-based economy. These knowledge activities have improved academics in every field, as well as science and technology, and culture and art. As a result, the products of research are constantly growing in

Korea. The number of patent registrations, many of which are in the fields of science and technology, rose from 4 in 1948 to 120 thousand in 2007. This rapid growth in intellectual property rights over the last 60 years reflects the development of Korea's ability to create knowledge due to factors including higher education. A major factor in these results is the growth in research output due to the government's policies such as BK 21.

6.1.4 Korea's university and research

According to informants, Korea's various sectors need human resources in advanced technology such as information technology, energy and materials. Therefore, Korea higher education relates to quality, differentiation and endeavor to enhance human resource capacity to respond more creatively and challenge of globalization and knowledge-based economy. Brain Korea 21 (BK21) project is an example of Korea's government to nurture research universities to meet the demand of high quality human resources. The seven-year project, which started in 1999, has enhanced greatly to improve the research capacity of universities and developing excellence human resources. Universities participated in BK21 have reformed their administrative systems and improved student selection methods to become research-oriented institutions. For example, they enhanced research capacity by introducing pay-on-performance based on professors' research achievements. This helped creating research environment. The second phase of BK21, which began in 2006 through 2012, continues to create high quality R&D human resources. It will focus on the science and technology sector that will have more direct impact on nation's economic development. Excellence researchers, particularly, students in Master and Doctoral degree, were received grant for the development and BK21 helps to support well trained graduate students in the area which Korea society needs.

6.1.5 Brain Korea 21 and knowledge-based economy

Brain Korea 21 is one of an example of Korea's strategies to make the use of existing knowledge-bases. The project helps to upgrade university research and prepare world-class students in Master's or PhD degree and post-graduate researcher. Major achievement of BK21 is increasing in number of articles published in

international journals and domestic patents. Moreover, the number of graduates and researchers increase as well. Therefore, BK21 helps to develop Korea's human research in key areas such as S&T, engineering, etc, and stimulate research and development within universities which will drive economic growth in the future.

6.2 Summarize research result: Thailand's human resources and knowledge-led growth strategies.

Education has been a major content in Thailand and higher education institutions play an important role not only in preparing the individuals for the workforce, but also as instruments of research and technological development. New product development, innovation and technology have been invented and generated from higher education institutions. Since the 1997 financial crisis, Thailand has embraced a shift in strategy towards greater investments in human capital as well as in R&D capacity. The development direction of the country in the past emphasized export-driven economic growth, using its comparative advantage in terms of abundant natural resources and relatively inexpensive labor. Facing increased competition from neighboring countries for foreign investment and human capital, the Eighth National Economic and Social Development Plan (1997-2001) highlighted a pressing need for enhancing technological competence in order to move up the production value chain.

6.2.1 Thailand and knowledge-based economy

The Eighth National Social and Economic Development Plan (1997-2001) was a major turning point of national development plan by emphasizing on people-centered development. However, Thailand encountered with severe economic crisis and needed to rehabilitate the economy to be more stable and reduced the impact which caused unemployment and poverty. People-centered development policy was contained in the Ninth National Social and Economic Development Plan (2002-2006) aligned with sufficiency economy policy. The outcomes of 9^{th} plan were satisfiable and Thailand's economy constantly expanded in average 5.7 per year. The policy continues to proceed in Tenth National Social and Economic Development Plan (2007-2012) while Thailand still confronts with changes in various contexts as follows. Thailand needs to encounter with global changing in different aspects.

Globalization leads to economic integration thus, aggressive trade policy is needed to enable domestic producer to compete in knowledge-based economy. Moreover, rapid changing in information technology affects economy and society thus, education development is very important. The average year of schooling in Thailand constantly increased to 8.5 per year and workforces who completed higher than primary school increased to 39.8 percent in 2005. However, the efficiency of Thai labor force is still below average compared with neighbor country such as Malaysia, Korea, Singapore, Taiwan, and Japan. Moreover, mid-level and high skilled worker are still insufficient and lack of quality. The R&D investment is only 0.26 of GDP which is 7 times under average and application of knowledge in business is still low as well. Therefore, they become weakness to create knowledge, innovation and R&D for national development and block competitive capacity in international level.

Therefore, the approach to accelerate the knowledge-based economy in Thailand is manpower improvement to create excellence in innovation and new knowledge which lead to development of the nation as follows;

1. Produce and improve high quality manpower which bases on the science of self-reliance by accelerating new researchers to meet the requirements of market and Thai society and to become a pillar in country development. Moreover, to improve the capacity of researcher to be more creative and proficiency to build innovation which useful for society. and development of existing potential.

2. Establish infrastructure to support science in all fields by focusing on participation, motivation and expand educational resource in all regions.

3. Develop life-long learning by encouraging Thai people to learn continuously and be able to access to knowledge resources both modern science and intelligence of locality. Promote learning in a variety of styles and adjust the environment to afford a society of learning.

4. Systematically manage knowledge to promote the learning of the Thai people and build national competitiveness on the world stage.

6.2.2 Outputs of Thailand's higher education

1) Student enrollment in higher education institutions, increased from 1,872,000 in 2001 to 2,430,600 in 2006. This growth is likely to continue as it is

estimated that high school graduates will increase from 0.7 million in 2000 to 1.8 million in 2016, an increase of 150 percent in 15 years. The OECD graduation rate in 2007 average is 70 percent.

2) Thailand increased its publication from less than 500 articles in the mid-1970s to over 3,000 articles per year by 2004 according to the Science Citation Index (SCI). This trend began to strength in the mid-1990s. However, Thailand's faculty overall are below 1 percent in all academic fields which are small as a share of publication worldwide. In comparison to other Asian nations, Thailand's average scholarly output per year was less than half of Singapore's production, but close to double of Malaysia in 2000 to 2005. However, the number of publications by faculty in China, Korea, and Taiwan was significantly larger.

6.2.3 Outcomes of Thailand's higher education

Thailand's higher education gross enrollment rate in 2007 is similar to other East Asian countries, except South Korea which is slightly higher. Even though Thailand started with much lower student participation levels than all the other countries in the region, Thailand has increased access to secondary education significantly. However, Thailand in just a decade nearly caught up with South Korea. Thailand also showed significant progress both in terms of secondary and higher education gross enrollment rate in comparison to Malaysia and the Philippines. However, Thailand still lags behind OECD countries in higher education enrollment ratios. The number of students enrolled in higher education has expanded steadily and dramatically since the 1970s, and particularly over the last ten years. The total number of higher education students increased from 78,000 in 1971 to over 2 million in 2005. The greatest jump in enrollments took place at the beginning of the 1990s, as a result of the increasing demand for high-skilled workers.

6.2.4 Thailand's university and research

The Office of Higher Education Commission (OHEC), Ministry of Education launched the National Research Universities Project in 2009 to build capacity of universities in Thailand to be world-class universities, develop Thailand as a regional education hub and strengthens human resources in research and innovation to increase

Thailand's competitiveness at the international level. The main incentives of NRUs are budget for research infrastructure and research funds for graduate students, post-doctoral researchers and research professors. Particularly, open competitive research grants which allow equal access to research funding for researchers from different fields. It could be said that funding of NRUs provides another sources to support research activities in universities. For activities of research, development of National research Universities and promotion of national research are 2 main activities to solve country's problems. Outputs are research product from NRUs project which each university promised to submit when the project ended. Outputs may change in quantity, as seen by the number of doctoral and master degree holders, publications, patents, etc. It could be said that NRU's project is another publication drive program for Thailand as well. For quality, the impact factor and the number of publications which were published in top journals are increase. Another output of NRUs is that the project increases a research environment both within universities. For human resource development, the one of the interviewees said the number of master degree students who respond to labour market needs are increasing. For outcomes, there will be national research universities occur in Thailand and help to upgrade universities ranking in the future. Moreover, the project helps to improve the size and quality of the pool of knowledge workers.

University becomes to play more roles on producing graduates to serve the manpower needs of the nation. Research and postgraduate universities play important roles in developing Thai higher education's academic excellence by generating new body of knowledge and technologies appropriate to Thailand's needs. A strong university system is a stepping stone to the third necessary ingredient for a successful innovation system, namely R&D. This includes R&D conducted by leading universities, research institutes and corporate labs. Yet a focus on R&D is not feasible without a high level of technical skills, which is why raising the quality of at least a network of core universities is intrinsic to efforts to build an innovation system. Therefore, National Research Universities project support knowledge-growth strategy by encompassing two principal components: development of National Research University and promotion of university research.

1. Development of National Research Universities. The concept of NRUs is

an agent to solve the country's social and economic problems. Therefore, selected NRUs are the instrument to solve social and economic problems. This project also represents an effort to promote university research by taking advantage of open competition research grants to allow equal access to research funding for researchers from different fields and establishing innovations in operating management for monitoring and assessing the effectiveness of research grants and their output which stimulate qualified research production

2. Promotion of University Research. This project represents an effort to promote university research with specific emphasis on specialized universities and undergraduate universities. Guiding concepts and strategies to implement the funding mechanism for university research and integrated research funding system that matches various age groups in the university will be created to strengthen the research capacity of university academics and staff with multidimensional objectives and enhance country's competitiveness.

6.2.5 National Research Universities and knowledge-based economy

National Research Universities help to stimulate attentiveness in research production and develop human resource especially graduate and post doctoral in various fields to supply the need of industries and communities. Therefore, the project will help produce a large number of researchers who will support the country's social and economic development. The project also helps to increase the competitiveness of the nation and human resources with creative knowledge which is necessary for sustain economic development in the future.

In the era of globalization, Korea and Thailand's key strategy to develop qualified human resources is to develop world class research oriented universities in specific field by;

1) Improving the research capabilities of faculty and graduate students.

2) Enhancing the quality of research

3) Upgrading research potential of universities in general and promoting universities with research capabilities to become national research universities which can compete with world-class university.

4) Producing human resources in various fields to respond to demand of community, industry, and innovation system which lead to enhance competitive capability

Brain Korea 21 and Thailand's National Research Universities help to increase the size of the pool of trained research workers by increasing the production and retention of such workers. The two projects also seek to increase the size and the quality of the domestic pool of knowledge workers. Furthermore, they stimulate high quality globally competitive research. The universities participating in the program will compete with each other to become winner of the program to attract high qualified student and to receive the advantage in applying to other education-related project in the future. Those universities will recruit high quality professors and researchers to increase capability of the university both domestically and internationally. However, some universities in NRUs project could not conveniently disburse budget due to the different of administration. Thus, the 9 national research universities should have more autonomy to allocate budget by themselves. Moreover, Thai government should support NRUs project both in terms of budget and continuity. The project should receive more budgets and should be long-term project to encourage, monitor and estimate the project consecutively so that Thai universities could nurture high quality graduate students and researchers to build world-class research universities in the future and produce human resources for a knowledge-based economy in the 21st century.

6.3 Guidance for Thailand's National Research Universities

The analysis of research helps to understand Brain Korea 21 project's advantages to strengthen higher education capacity for knowledge-based economy. and able to find policy for Thailand's higher education institutions development as follows;

1. BK21 is long-term project while NRUs is short-term project. Therefore, NRUs should extend the period of project to understand the process and problems of the project. The continuity of the project also helps to enhance incentives to conduct research among students and researchers in universities and increase the incentives of recipients to conduct their researches.

2. BK21 project's budget is a large funding and stable while NRUs budget is quite small and instable. Hence, increase overall R&D budget especially for support NRUs and authorize each university in the project to allocate budget by themselves or improve budget disbursement would help to increase the flexibility and decrease the delay of budget problem.

3. BK21 enhances competitiveness while NRUs enhance research collaboration. Even though research collaboration in NRUs will lead to establish networking and linkages among universities and other institutions, the incentives to conduct research are still less than competitive incentive. NRUs should stimulate the collaboration within institutes while compete to produce research output with other institutions.

4. BK21 increases research production while teaching is decreased. NRUs should realize about this problem and try to support research align with teaching.

6.4 Research limitation

The Brain Korea 21 project's implement period is between 1999-2012 and National Research Universities is between 2010-2012. Thus, there are limitation in term of outputs and outcomes of BK21 Phase II (2006-2012) and NRUs ' ones as well because the project is still proceeding.

6.5 Suggestion for further research

1. There should be a study concerning the outputs and outcomes of Brain Korea and National Research Universities after the projects terminate to obviously show more effects of the projects to society and economy.

2. There should be a research on higher education promotion for knowledge-based economy in comparison among Korea, Thailand and ASEAN countries in the future.

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Appendix

Appendix : The Interview Questions

Topic: Higher education development and Korea transition to knowledge-based economy

Name:

Workplace:

Position:

Date and Time of Interview:

Questions:

1. How does higher education support economic development of Korea?
2. How does the promotion of research and development (R&D) support economic development of Korea?
3. The role of universities in national R&D is quite small in Korea. What is the policy to increase the role of universities in increasing them?
4. How the government support university and industry link?
5. How the Brain Korea 21 projects encourage R&D and linkage between university and industry?
6. What are the criteria for selecting university to participate in Brain Korea 21 project?
7. How Brain Korea 21 project outcome support human resource development in Korea?
8. How is the trend of higher education and R&D of Korea in the future?

Topic: Question for Brian Korea 21 and National Research Universities

1. Before your university was selected to participate in BK21/NRUs project, how Yonsei University prepare to meet the selection criteria of Brain Korea 21?

2. After your university was selected to participate in BK21/NRUs project, did graduate students, professors and researcher have more incentive to do researches? Please describe.

3. After your university participated in BK21/NRUs project, how the research activities change? (For example, the number of PhD. and MA student, the number/quality of research, University-industry collaboration, research environment)

4. Positive and negative effects of Brain Korea 21/NRUs project for your university in your opinion?

5. Do you think the budget which received from BK21/NRUs project is enough?

6. Do you think BK21/NRUs project help to develop human resources in Korea/Thailand? How?

7. Do you think BK21/NRUs project's outcomes respond to labour market?

8. How do you follow and evaluate your university to meet the criteria of BK21/NRUs?

9. Your expectation about BK21/NRUs

10. Your suggestion about BK21/NRUs

11. Do you think BK21/NRUs project help to develop Korea/Thaialnd into knowledge-based economy? How?

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