

2011 教育部

邁向頂尖大學計畫

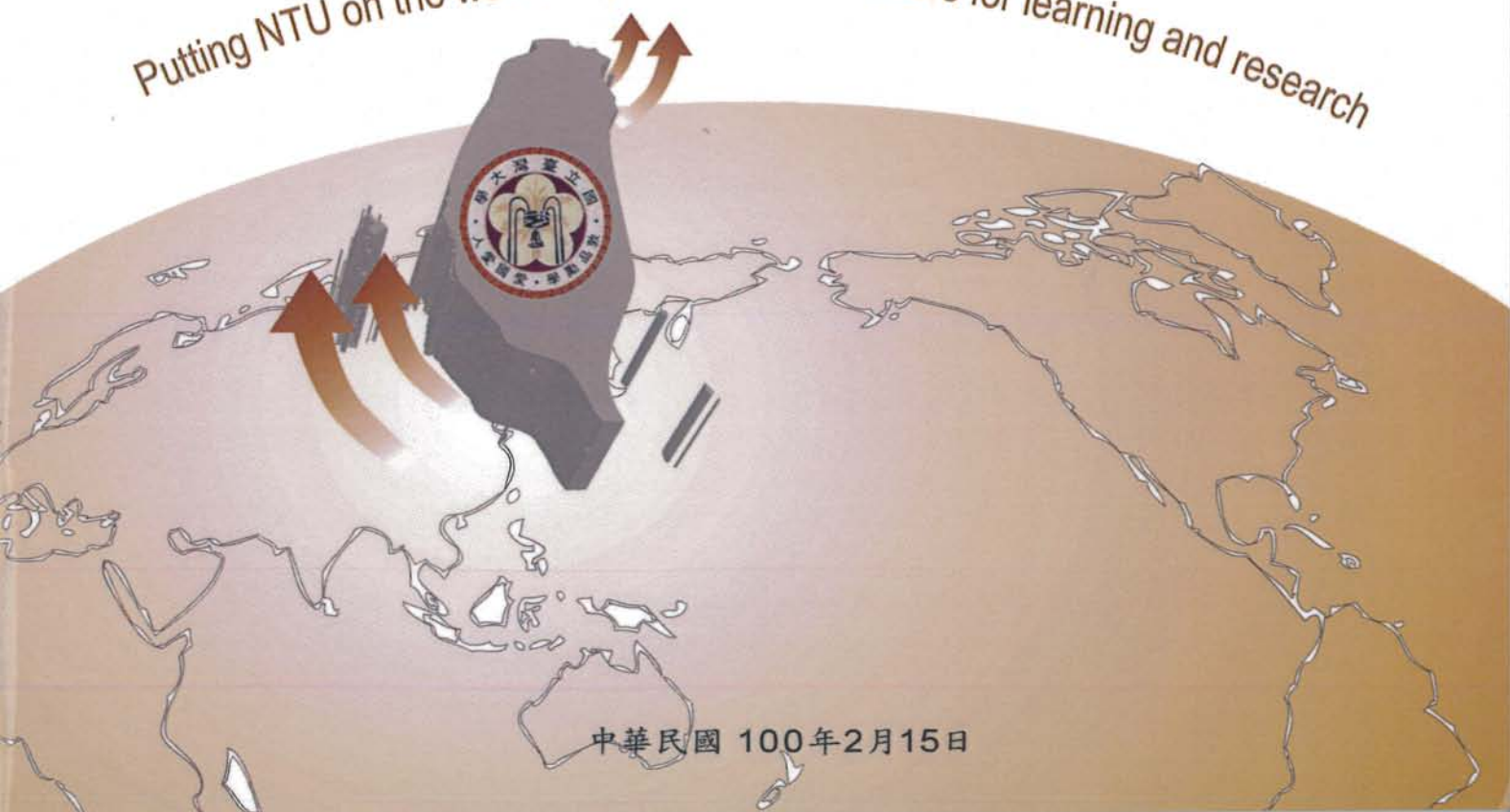
Aim for the Top University Project

國立臺灣大學

National Taiwan University

躍昇國際學術研究重鎮

Putting NTU on the world map of excellent centers for learning and research



中華民國 100年2月15日

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Abstract

With funding from the first phase of the Ministry of Education’s Worldclass University Initiative (also known as the “Aim for the Top University Project” or the “5-Year, 50 Billion” project), National Taiwan University invested heavily in a campus-wide modernization effort to build an excellent infrastructure for teaching and research. Committed to a “balanced growth with key strategic breakthroughs”, the University aimed at a short-term dramatic increase of the output of high-quality published research papers, and an intermediate goal of catapulting 10 to 15 of the University’s research areas into worldclass status, eventually placing the University among the world’s best 100. As it turns out, after a dedicated 5-year pursuit, we have almost doubled our output of research papers, with papers in 16 important areas entering the HiCi category. Last year, National Taiwan University joined the prestigious “Century Club” by placing 95th on the *Times*’ World University Ranking (WUR), and advanced 56 places (compared with five years ago) on the Shanghai Jiaotong World University Ranking list to land on the 127th slot, surpassing the University of Singapore to capture the crown position among all universities with pronounced Chinese ascendancy.

The current objective is to advance National Taiwan University to the 50th place to become a premium international institution of higher education. To that effect, NTU has made the University of Illinois at Urbana-Champaign (UIUC) a benchmark university. Using momentum accumulated from the first round of the Worldclass University Initiative, together with a strategic deployment of the University’s assets and resources, NTU remains committed to a “balanced growth with key strategic breakthroughs” to further upgrade its facilities for an improved infrastructure and to uphold the University’s core values. The immediate short-term goal is to dramatically increase the number of papers published in top international journals, to recruit international talents and train our own outstanding junior scholars, and to invest in prominent research centers with cutting-edge research capabilities and a potential to become worldclass to provide a solid basis for the development of the six rising industry sectors as well as support for important national agendas such as cloud-top computation to ensure sustainable growth for Taiwan. The University will also launch a number of forward-looking initiatives and collaborate with the Academia Sinica, prestigious international universities (such as MIT), and top research institutes (such as IBM and Intel) to explore new research frontiers. This, coupled with a balanced growth of the 11 colleges, will trigger a flywheel effect and catapult the University into the position of leadership as a top international university (Figure 1).

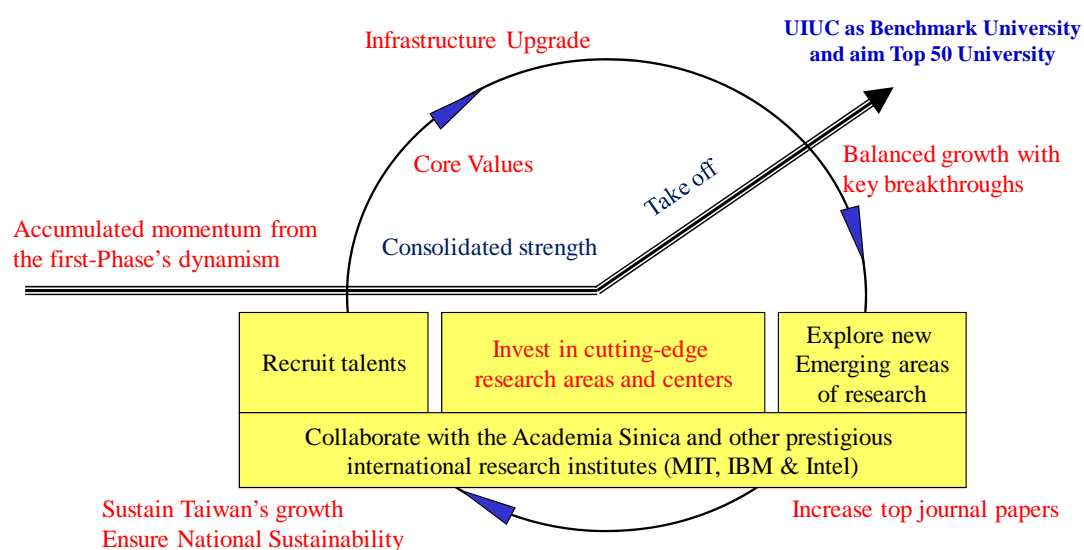


Figure 1 Establishing university-level research centers to trigger a flywheel effect to accelerate the journey to top university

Based on the overall objectives outlined in the “Top-University March” agenda of the University’s Intermediate Development Plan, National Taiwan University drafts the following five implementation strategies and guidelines to combine and consolidate strength with the 10 top research centers established on campus through funding from the Worldclass University Initiative for a high-quality teaching and research platform to train elite social leaders as well as knowledge and industry pioneers. The five implementation plans are: Multidisciplinary Excellence Education, Recruitment of Teaching and Research Talents, Building Better Infrastructure and Hard- and Software, Excellence and Forward-Looking Research, and Academic Internationalization (Figure 2). In addition to funding from the Ministry of Education, NTU is building a Campus Sustainability Fund via strategic alliances with the industry and various government departments to retain and recruit talents to ensure a sustainable campus for worldclass research to advance to the world’s top 50 universities. NTU will establish a joint research center for top international universities to launch multinational research projects to raise the University’s profile.

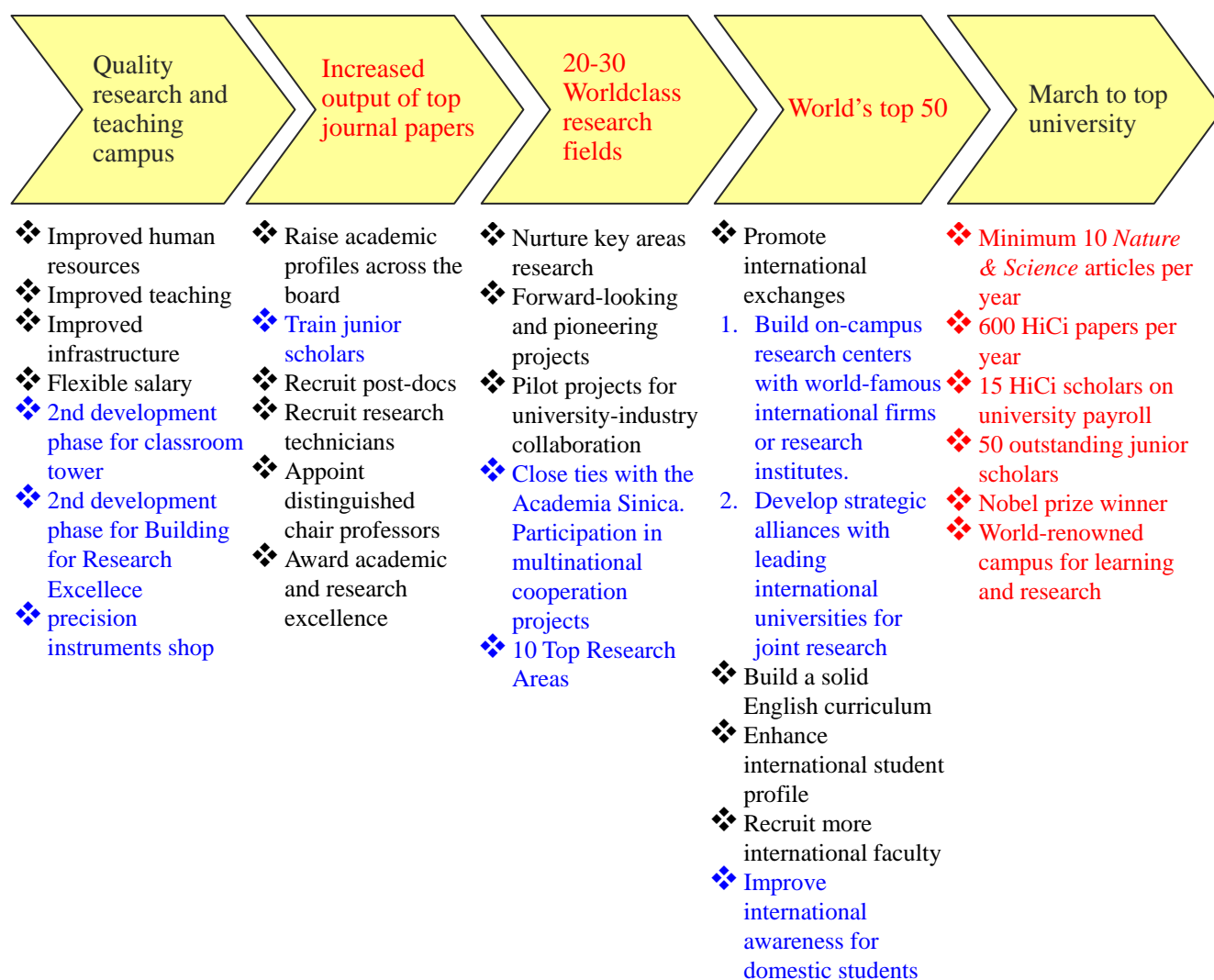


Figure 2 Overall Objectives and Strategy for the March to Top University

One of NTU’s fundamental missions is ‘to boost the nation’s economy and resolve key issues concerning humanity’s sustainability.’ To this effect, the current project takes into consideration the important issue of social sustainability and the substantial role of a worldclass research university in a developed nation. Scanning the horizon for clues for Taiwan’s future and in accordance with the

University's research capability and key directions, NTU drafts the following five major areas of concern: 1) refinement and preservation of cultural heritage, 2) serious pursuit of basic academic subjects, 3) lay the foundation for sustainable social development, 4) develop knowledge economy and the technological industry, and 5) promote health care and a healthy life style.

To address these five concerns, the current project aims to hitch a ride on the success of the past five years to carefully select from the pioneering projects 10 university research centers with worldclass research capabilities and a potential to become leaders in the field for major support. These ten centers are: 1) Institute for Advanced Studies in Humanities and Social Sciences (IHS), 2) Center for Information and Electronics Technologies, 3) NTU Center of Genomic Medicine, 4) Center for System Biology Research, 5) Neurobiology and Cognitive Science Center, 6) Research Center for Climate Change and Sustainable Development, 7) Institute for Advanced Study in Theoretical Sciences, 8) Biomedical Molecular Imaging Research Center, 9) Center of Emergent Materials and Advanced Devices, and 10) Health and Smart Living Research Center.

These 10 research centers will serve as multinational platforms for international collaboration as well as for the recruitment of talents. Five years down the road, with funding from the 2nd round of the Ministry of Education's Worldclass University Initiative, NTU expects to become a premium institution of worldclass facilities for leading researchers to conduct cutting-edge research with worldclass results. With 600 HiCi papers per year, 50 distinguished young scholars and 15 or more HiCi authors in residence, 10 top international research centers, and 20-30 fields recognized as world number one, NTU will achieve its goal of becoming one of the world's best 50 universities. This will put NTU on the world map of excellent centers for learning and research.

1. Preface

National Taiwan University (NTU) is a comprehensive research university that students have strived to enter. NTU has cultivated society's finest interdisciplinary leaders and innovators in the knowledge industry. In 2005, the Ministry of Education (MOE) launched the first phase of its five-year project, the "Program for Promoting Academic Excellence of Universities and Top Research Centers", to provide new opportunities for NTU on its long-term development as a world-class university. To reach the goals of this project, NTU defined its own institutional mission and vision, undertook a careful evaluation of its strengths and weaknesses and the risks and opportunities it would confront in its development. Furthermore, the university formulated short-term, mid-term, and long-term development goals and implementation strategies in accordance with the core values and concepts of NTU. After over 4 years of efforts, NTU has joined the ranks of the world's top universities and set the foundation as an international academic bastion.

The mission of NTU is **to provide an excellent environment for students and faculty to learn and create, to offer leaders of society and researchers the most innovative knowledge, to raise the level of Taiwan's academic quality, to boost the nation's economy and resolve key issues concerning humanity's sustainability.** Broadly embracing top academics from around the world, NTU aims to become a renowned bastion of education and research in fulfilling its vision to be **"No.1 World-class Chinese University"**.

2. Self Analysis and Evaluation of Current State

2.1 About NTU

Founded in 1928, NTU is Taiwan's most full-fledged and the first comprehensive university with the longest history. NTU currently has 11 colleges: Liberal Arts, Science, Social Sciences, Medicine, Engineering, Bio-Resources and Agriculture, Management, Public Health, Electrical Engineering and Computer Science, Law, and Life Science; and 2 schools: School of Dentistry and School of Veterinary Medicine. As of 2009, NTU had a total of 54 departments and 103 graduate institutes (offering 91 doctoral programs and 100 masters programs), with an enrollment of 17,514 university students and 15,997 graduate students. There were 3,276 full-time staffs in 2009 (including 1,972 faculty, 11 researchers, 20 rare technicians, 248 teaching assistants, 682 staff members, 34 security guards, and 312 messengers/janitors), and 621 staffs (31 teaching and research staff members and 590 administration staff members) recruited from school affairs fund (including contract staff). The above departments, institutes, faculty, and students are evenly distributed into each of the four main areas: (1) Humanities and Social Sciences, (2) Natural Sciences and Mathematics, (3) Life Sciences, Medicine and Agriculture, (4) Engineering and Applied Science.

The number of university students at NTU is roughly the sum of university students at National Cheng Kung University (NCKU) and National Chiao Tung University (NCTU) combined, reflecting the fact that NTU is Taiwan's largest, oldest, and most representative school for higher education, with

the most complete suite of departments and programs. Every year, nearly every one of the top high school students in Taiwan strives to enter NTU, and almost every winner of an international science competition applies to study at NTU.

NTU continues to adhere to the school motto formulated by the late university president, Fu Ssu-nien, in pursuit of "university autonomy and academic freedom" in order to "**cultivate character, engage in serious learning, and practice love of country and others**", and to encourage all NTU members to live by these principles. In the effort to renew campus culture and civic values, President Lee Si-Chen has added new meaning to the school motto, by defining character as "**fidelity, integrity**"; **rigorous study** as "**professionalism, excellence**"; **love of country** as "**caring and compassion**"; **love of others** as "**tolerance and contributing to the happiness of others**", in the hope that cultivating these qualities will result in a superior campus culture. NTU will remain dedicated to its core philosophy of "**excellence in education, excellence in research, and care for society**" for future development.

2.2 Major Achievements of NTU

2.2.1 Achieving the Phase-Based Overall Objectives of Entering the World's Top 100 Universities

The first phase of NTU's "Aim for the Top University Project" (The ATU Project) endeavors to establish a quality learning and research campus environment by identifying and supporting the research teams with the most potential for becoming the top, and elevating research levels of all fields; this is the concept of "**balanced growth with key strategic breakthroughs**". The principal objective of the first phase is to **reach world-class status in at least 10 to 15 academic fields within five years** and join the ranks of the world's top 100 in five to ten years in the second phase, so as to be recognized as the pinnacle of the Chinese community and a top-rated research university in the world.

In The Times Higher Education–QS World University Rankings 2009, which was released in The Times Higher Education Supplement, NTU has broken into the top 100 world universities with **an overall ranking of 95**, compared to its **114th-place rank in The Times' 2005 survey**. As for the rankings in five areas of expertise (arts & humanities, engineering & IT, life sciences & biomedicine, natural sciences, and social sciences), NTU broke its 2007 record by entering the top 50 in two subject areas: engineering & IT (47) and life sciences & biomedicine (45). Improvements have also been made in the area of arts & humanities (60th-place rank from 152nd in 2008) and social sciences (58th-place rank from 74th in 2008) among world universities in 2009.

In the Academic Ranking of World Universities (ARWU) announced by Shanghai Jiaotong University, NTU's ranking ascended from **the 183rd-place in 2005** to **the 127th-place in 2010** after four years of efforts, surpassing National University of Singapore (145) and Seoul National University (148), and topping **all other universities in Asia (see Figure 1)**. This result is indicative of the achievements made in implementing the first phase.

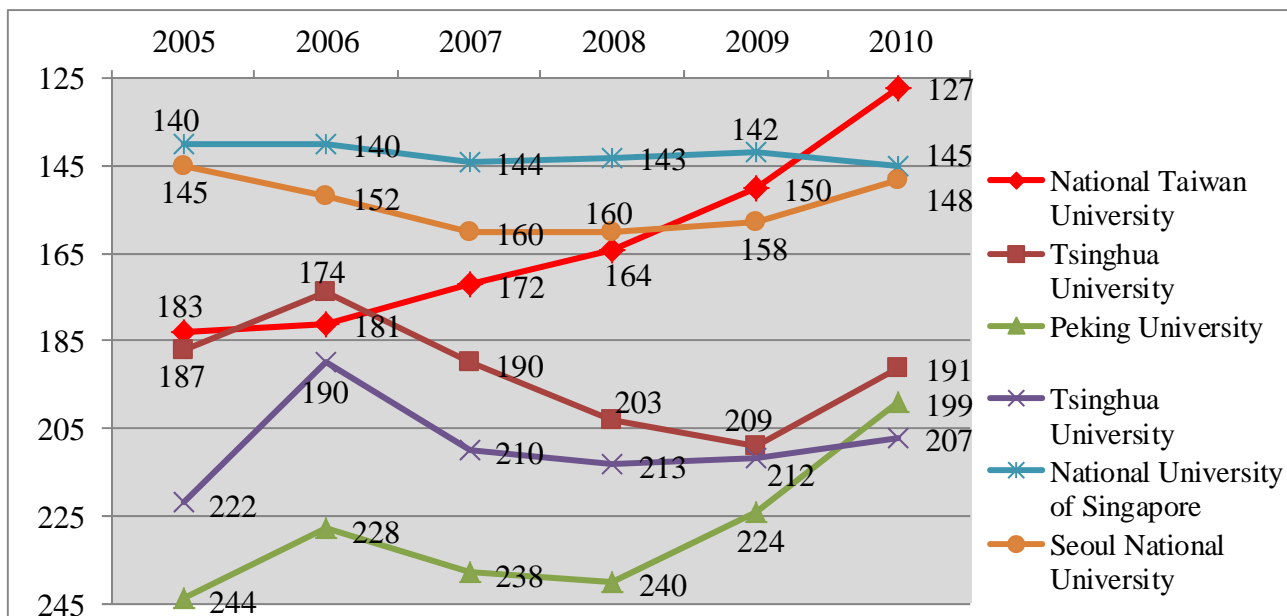


Figure 1 Shanghai Jiaotong University ARWU 2005-2010 Ranking of Representative Universities in Asia

As for domestic research achievements, NTU received the following elite level awards between 2000 and 2009: the National Chair Award of the MOE (receiving 35% of awards among all domestic universities and 42% among 11 research universities), Academic Award of the MOE (33% among all domestic universities and 46% among 11 top research universities), and Outstanding Research Award of the National Science Council (27% among all domestic universities, and 38% among 11 top research universities). Despite all these significant achievements, NTU has only received 30% of annual subsidies among 11 research universities from the ATU Project between 2006 and 2010.

Teaching and research aside, the first phase of the ATU Project aims to renew campus culture and civic values, cultivate traditional core value, and establish a superior campus culture. In the “2010 Top 1,000 Enterprises’ Favorite College Graduates” survey conducted by Cheers business magazine, NTU ranked the first place for four consecutive years after surpassing NCKU in 2007. The second and third place went to NCKU and NCTU. Among 8 abilities indicators, NTU topped other universities in 5 areas while NCKU in 3 areas. With the ability to achieve mastery and to cohere, NTU graduates are considered the most popular in domestic big corporations.

2.2.2 Achievements in Teaching

NTU recruited 462 new faculty members during the 2005 and 2009 academic years; many are outstanding academic talents, including 3 academicians from Academia Sinica. Although the number of students in the past 5 years is on the increase, the student-teacher ratio has continuously decreased from 14.7 in 2005 to 14.0 in 2009.

NTU has continued to formulate teaching quality enhancement strategies, and has completed two important documents: the “NTU White Paper on Excellence in Teaching” and the “Secret Teaching Methods of NTU Faculties”. The academic affairs are now fully digitalized: the “curriculum mapping”

has greatly helped students in course selection and career planning. NTU has also established the “student learning portfolio” system and the “teaching portfolio” system is about to complete. With the budget from the ATU project, the “Teaching Assistant System” has been developed. Around 1,000 graduate students served as teaching assistants every year to improve the quality of instruction, and have been highly recognized. The aforementioned establishments have greatly elevated teaching techniques and students’ outcome. The increase in course evaluation rating (see Figure 2) is indicative of the increased student satisfaction on the courses offered.

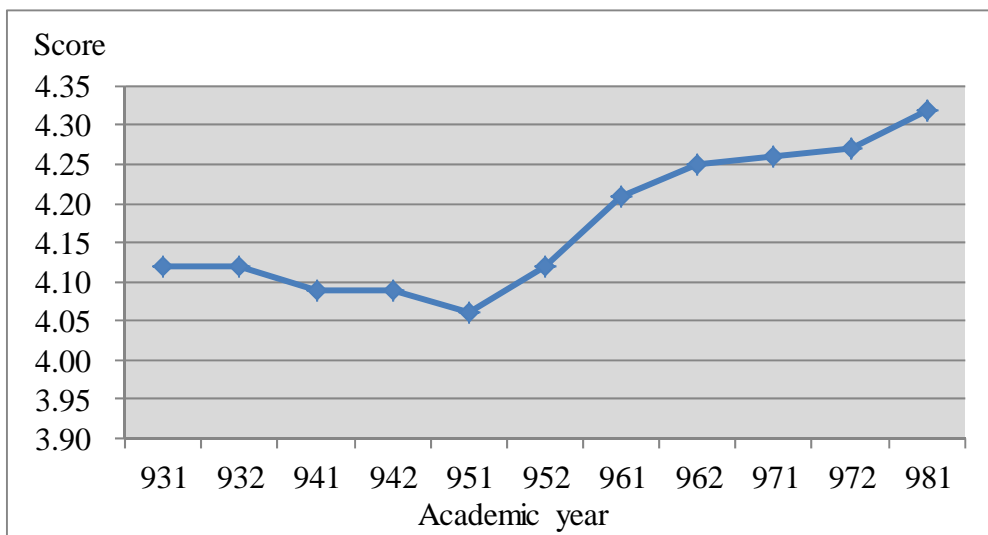


Figure 2 Annual Increases in Course Evaluation Ratings

In order to provide greater opportunities for students to a systematic and diversified learning, NTU currently offers 40 academic credit programs and 3 graduate school credit programs. Every year, there are around 1,500 to 1,600 students taking interdisciplinary academic programs (including double and minor majors), which is around 10% of the university students enrolled. In addition, the Freshman Seminar Program was established to provide small-group instruction to freshmen to explore the correct learning attitude and method, How to evaluate oneself and understand the nature of incidents. The university offers 12 Freshman Seminar Programs every semester and the students have highly valued these courses.

In 2008, NTU established the Freshman Orientation Academy to strengthen the effects of freshmen orientation consultation and construct a quality learning environment. In 2009, 3,800 freshmen participated in activities that introduced the core values of the school and college life. Other courses include course selection consultation, campus security, general health examination, library induction, campus tour, interpersonal relationships, learning method and portfolio, learning navigation, and registration procedure. Gender equality and ethical education seminars are also provided.

With the aforementioned measures, the teaching quality of NTU is highly recognized. The recent higher education evaluation also rated NTU as the research university (see Figure 3) with the most evaluated units (194) and the highest passing rate (99.5%).

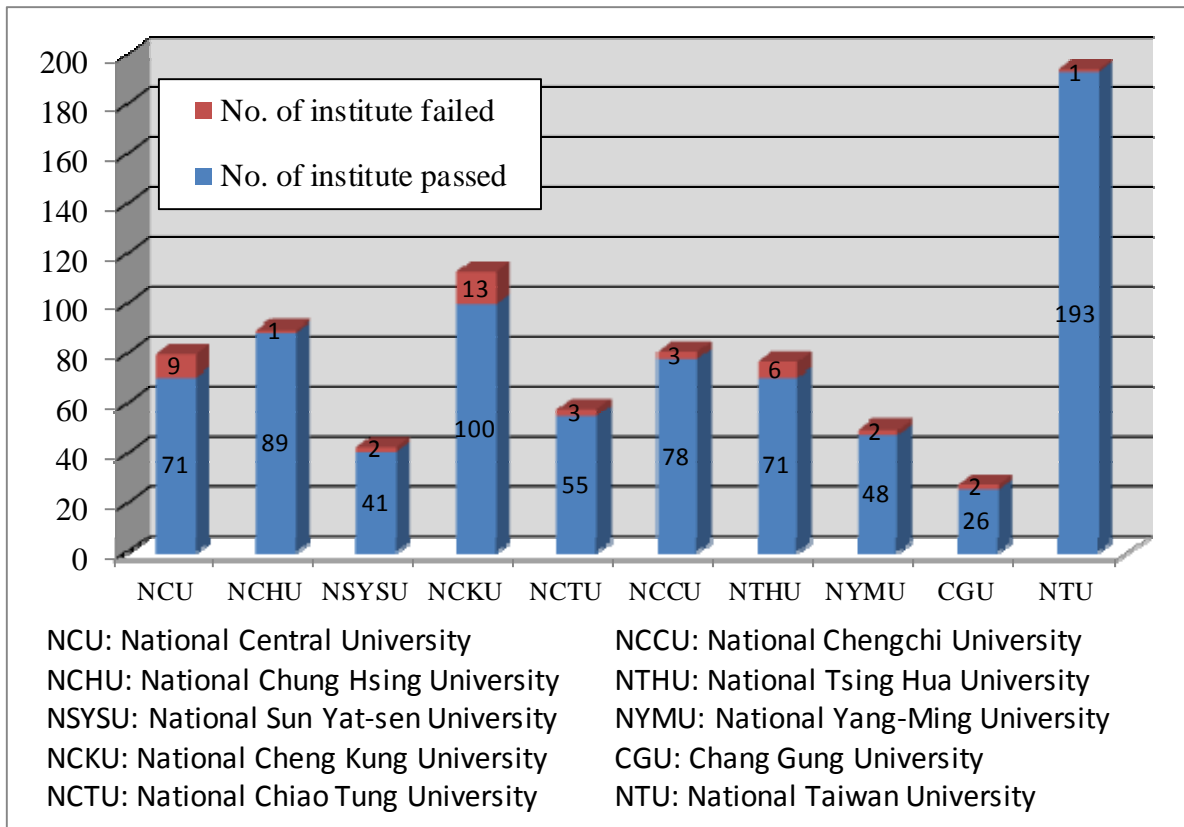


Figure 3 Outstanding Performance of NTU Rated by Higher Education Evaluation & Accreditation Council of Taiwan (HEEACT)

2.2.3 Achievements in Research

In order to achieve the overall objectives and annual performance indicators of NTU's ATU Project, NTU actively promotes outstanding and cutting-edge research, and cautiously selects and supports world-class research teams. NTU expects to reach world-class status in at least 10 to 15 academic fields within five years, in addition to actively promote emerging fields and industry-university cooperation and strengthen improvement measures.

Since the implementation of the ATU Project, the total number of papers published in SCI listed journals increased from 3,378 in 2005 to 4,783 in 2010, showing a growth of 42%; the number of papers published in SSCI listed journals increased from 150 in 2005 to 410 in 2010, a growth of 173% (see Figure 4); the number of papers published in A&HCI listed journals increased from 8 in 2005 to 31 in 2010, a growth of 288%; the number of papers published in TTSCI listed journals increased from 120 in 2005 to 191 in 2010, a growth of 59%. Significant growth is seen in all academic research areas, especially faculties in the humanities and social sciences, where the number of papers published in SSCI and A&HCI has dramatically increased. In addition, the number of highly-cited (HiCi) papers grew 71% from 129 in 2005 to 221 in 2009. From 15% and 40% of high impact factor of SCI, SSCI, A&HCI journals during 2004 and 2009, papers published in top 15% by NTU faculty increased from 37.3% in 2005 to 40.0% in 2010; top 40% paper publication increased from 67.6% in 2005 to 69.1% in

2010. The average IF value of the number of papers published in top 40% in the past 6 years has reached 69.6% of the total publication. These growths are indicative that the academic research performance of NTU is close to the doubled quality and quantity objective of phase one.

In the efforts to elevate international visibility, international conferences were organized and renowned scholars from abroad were invited to teach and conduct research. NTU also administered the “Subsidy Rules for the Promotion of Cross-Border Research Cooperation” to encourage active involvement in international research exchanges with foreign academic research institutes and industries. The increase in the number of national chairs in world-class science or engineering fields abroad (from 9 in 2005 to 29 in 2010), fellows of major international associations (from 77 in 2005 to 158 in 2010), and editors of major international periodicals (from 227 in 2005 to 620 in 2010) are all the results of enhanced international awareness.

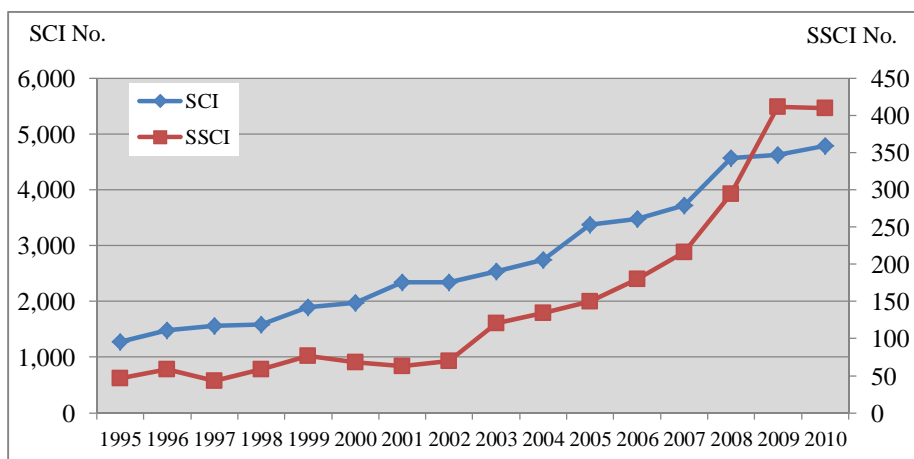


Figure 4 1995-2010 NTU Paper Publications in SCI and SSCI Listed Journals

2.2.4 Achievements in Academic Internationalization

Since the ATU Project was implemented in 2005, the number of international academic exchange activities and foreign scholar visits grew from 3,783 in 2005 to 5,894 in 2009. NTU’s partner schools increased from 182 schools in 2005 to 361 schools in 2009, especially in Southeast Asia and Europe, where partner school exchanges experienced major breakthrough. The many and varied cooperative ventures NTU maintain with these partner schools include 35 dual degree (joint degree) programs, 194 student exchange programs, 6 teacher exchange programs, and 15 summer sessions. The number of international organizations for higher education in which NTU participates in grew rapidly from 4 to 9, including the Association of Pacific Rim Universities (APRU) and the Association of Southeast Asian Institutions of Higher Learning (ASAIHL), of which NTU is the only member from Taiwan. NTU also chaired the University Mobility in Asia and the Pacific (UMAP), hosting several major international conferences, including: 2007 UMAP International Conference, 2007 APRU Senior Staff Meeting,

2007 Association of East-Asian Research Universities (AEARU) Student Summer Camp, 2008 Conference of Asian University Presidents (CAPs), and 2010 ASAIHL Conference. In 2009, NTU has successfully won the bid to host the 2011 Asia-Pacific Association for International Education (APAIE) Conference & Exhibition. There will be over thousands of college administrators from 500 schools and 50 countries participating in this event.

The number of international students has increased by 10% annually since 2005, with a total of 1,738 foreign students from 68 countries studying at NTU. The number of international exchange students staying over one semester has also greatly increased 21.9% from 382 to 489 in 2009. Apart from student exchange programs, NTU has also promoted a fee-paying “Visiting Student Program”, accommodating 31 students from US, Italy, Germany, France, and China, including prestigious schools such as Harvard University. NTU offers 33 programs in English (including graduate institutes providing enough English courses to satisfy graduation requirements). Some graduate institutes were invited to participate in the Erasmus Mundus program, organizing English courses with European renowned universities. In addition, the “NTU Regulations for Scholarship Support to Needy Students on Overseas Academic Exchanges” provides outstanding students to partner schools. The number of exchange students receiving the support fund has increased from 130 in 2005 to 362 in 2009. All of the above shows that the ATU Project fosters NTU’s internationalization, and that NTU has been successful in implementing the project.

2.2.5 Achievements in Industry-University Cooperation

Starting from 2006, with the funding from the ATU Project, the Division of Technology Transfer of the Office of Research and Development actively discover and manage (including application of patents, maintenance, marketing, and technology transfer) intellectual property owned by technology related colleges. The number of patent applications increased from 118 in 2005 to 379 in 2009. From the number of patent applications processed in Taiwan Intellectual Property Office, NTU led all domestic universities with 239 patent applications, with a place of 13th among the top 100 patent applicants in Taiwan. The total amount of industry-university cooperation projects has increased dramatically within 5 years, from NT\$4,844,933 thousand dollars in 2005 to NT\$ 7,627,570 thousand dollars in 2009, with a growth of 57%. The amount of industry-university cooperation projects with private sectors increased 204% from NT\$79,370 thousand dollars in 2005 to NT\$241,335 thousand dollars in 2009.

2.3 Self-Analysis and SWOT Analysis of NTU’s Future Development Criteria

2.3.1 Self-Appraisal

I. Analysis of NTU’s Highly-Cited Papers

A top university must be strong in each and every field. Therefore, the following analysis examines the world ranking of different fields between NTU and the University of Illinois at Urbana Champaign (UIUC) as NTU’s direction for improvement. The ESI (Essential Science Indicators)

database is divided into 21 professional fields and one interdisciplinary field; these 22 fields are further divided into 6 categories: Engineering, Life Science, Social Science, Science, Agriculture, and Medicine. Among the 22 fields, any field of a research institution that is included in the ESI ranking means that the number of times papers in that field were cited over the past 11 years has reached the top 1% (the threshold for that research institutions) of all research institutions around the world; the threshold for each field differs as the nature of different fields varies.

Among 22 areas of specialization in the ESI database, 13 fields of NTU were included in the ESI ranking (or top 1% in the world) in 2005. These 13 fields are evenly distributed in the 6 categories: Engineering, Life Science, Social Science, Science, Agriculture, and Medicine. By 2007, this number has increased to 15 fields (two additional fields are Microbiology and Molecular Biology & Genetics) in which the number of HiCi papers by NTU faculty ranked among the top 1% in the world. Also, the global rankings of 12 of these 15 fields based on total number of papers have improved. As of 2007, 4 fields were in the world's top 50 (Computer science, Engineering, Chemistry, Pharmacology & Toxicology), and 5 were in the world's top 50-100; in 2008, 5 were in the world's top 50 (Computer science, Engineering, Material science, Chemistry, Pharmacology & Toxicology), and 4 were in the world's top 50-100. In 2009, Geosciences also entered the top 100, with a ranking of 94. Therefore, in 2009, there were a total of 16 fields in which the number of times papers cited has reached the top 1%, 5 fields in world's top 50, and 5 fields in world's top 50-100 (see Table 1).

NTU had an outstanding performance in the Engineering category among all other aforementioned ranking. As of 2009, NTU ranked 44th (UIUC 28) in the Computer Science field, 22nd (UIUC 9) in the Engineering field, 47th (UIUC 62) in the Materials Science field. In the Life Science category, NTU's Environment/Ecology fields were 64th (UIUC 41). In the Social Science, General Category, NTU's Social Sciences has the greatest improvement, from 301st in 2006 to 239th (UIUC 27) in 2009. In the Science category, NTU was 39th (UIUC 55) in the Chemistry field, 95th (UIUC 87) in Geosciences, and 67th (UIUC 31) in Physics. In the agriculture category, NTU was 66th (UIUC 18) in Agricultural Sciences and 102nd (UIUC 30) in Plant & Animal Science. In the Medicine category, NTU was 80th (UIUC 634) in Clinical Medicine and 36th (UIUC 350) in Pharmacology & Toxicology.

The above analysis shows the strengths and weaknesses of NTU and UIUC in various academic fields. Among 22 fields, NTU is ahead of UIUC in 4 areas (Material Science, Chemistry, Clinical Medicine, and Pharmacology & Toxicology) with outstanding performances. In terms of publication quality, NTU only has 221 highly-cited papers (UIUC 728) and 6 highly-cited authors (35 in UIUC). This shows areas for improvement in paper quality. It is believed that under the strategy of overall academic enhancement and the financial support from the ATU Project, there will be significant achievements.

Table 1 NTU entered the ESI ranking in 16 academic fields, global ranking based on number of papers, and number of highly-cited papers (number of papers cited over the past 11 years entered the top 1% of all research institutions) between 1999 and 2009

Fields that entered the ESI ranking (1999-2009)		Number of papers	Global ranking	Number of highly-cited papers
Engineering	Computer science	993	44 (+1)	9
	Engineering	3,685	22 (+3)	36
	Materials science	1,576	47 (0)	27
Life Science	Biology & Biochemistry	1,279	160 (+22)	3
	Environment/Ecology	934	64 (-2)	3
	Microbiology	415	126 (+20)	1
	Molecular Biology & Genetics	608	198 (+16)	2
Social Science	Social sciences, General	503	239 (+13)	1
	Economics & Business	—	—	3
Science	Chemistry	3,831	39 (+1)	25
	Geosciences	941	95 (+7)	13
	Mathematics	—	—	3
	Physics	3,467	67 (+4)	34
	Space Science	—	—	4
Agriculture	Agricultural sciences	574	66 (+6)	3
	Plant & Animal science	1,363	102 (+2)	2
Medicine	Clinical medicine	6,965	80 (+2)	47
	Immunology	274	196	—
	Neuroscience & Behavior	—	—	1
	Pharmacology & Toxicology	650	36 (-7)	3
	Psychiatry/Psychology	—	—	1
	Number of fields to enter the ESI ranking	16		
	Number of highly-cited papers	—	221	

※ The above statistics were collected between January 1999 and December 2009, and last updated on March 4, 2010.

※ Only covers academic fields that entered the ESI ranking, which is the top 1% of all research institutions.

※ **Indicating in blue color**

※ **Figures in parentheses indicate progress (+) or regress (-) compared to last year's figures. A zero ('0') signifies no change.**

II. Global Rank of Total Number of Papers and Citations in the Past Decade

From the number of academic publications and the world ranking of NTU and UIUC in the past decade, NTU has gradually caught up to UIUC (see Table 2), except for the number of highly-cited papers within the past ten years, which NTU is still far behind (see Table 3). As for paper quality, NTU has entered top 200, which shows an improvement of 11 places. Better results can be expected in the future.

Table 2 Number of Papers and Global Rank of NTU and UIUC during 1998-2010

School Name	1998-2008		1999-2009		2000-2010		Improvements in Ranking
	Number of papers	Global rank	Number of papers	Global rank	Number of papers	Global rank	
UIUC	34,160	47	35,385	46	36,380	44	+2
NTU	28,384	65	29,528	60	30,755	55	+5

Table 3 Number of Citations and Global Rank of NTU and UIUC during 1998-2010

School Name	1998-2008		1999-2009		2000-2010		Improvements in Ranking
	Number of citations	Global rank	Number of citations	Global rank	Number of citations	Global rank	
UIUC	504,210	50	549,463	48	582,336	48	+0
NTU	208,246	203	243,986	179	267,251	168	+11

2.3.2 SWOT Analysis

NTU has been founded over 80 years. With the largest school campus in Taiwan, NTU has a complete administration structure, high quality and strongly-united administrative personnel. NTU is a comprehensive research university with evenly developed academic fields, outstanding faculties and students. Most alumni are leaders of domestic/foreign circles. With academic freedom, autonomous colleges, and diverse thoughts, NTU is in the leading position in domestic academia, and the most significant Taiwanese university of international academia.

However, over the past few years, due to lack of resources in higher education, old school buildings, narrow spaces, and infrastructure requires improvement. Over high student-teacher ratio, heavy teaching load, low professor salaries and the lack of administration flexibility make NTU uncompetitive with other professions in the same field or first-class universities of neighboring countries. Although personal academic performances are outstanding, interdisciplinary integration is still insufficient. Balanced development has been maintained, but some fields need to be strengthened. In addition, there are too many restrictions from government regulations, rigid system affects administration efficiency.

China's key universities are catching up from behind, as a result of its rapid economic growth. The competition between NTU, domestic/foreign universities, and Academia Sinica for outstanding faculties is becoming more and more severe. The recruitment of top scholars from abroad has been more and more difficult.

Being the oldest university in Taiwan, NTU has accumulated the most full-fledged research materials and teaching experiences in each field from historical heritage. NTU possesses an international reputation which gives it more opportunities for academic cooperation. The 21st century is the era of knowledge economics; EECS, Biotechnology, nano science, and medicine have become the mainstream of development. NTU has made breakthroughs in all of these fields in hopes of becoming first class university. Emerging fields and industries are produced from NTU's interdisciplinary teaching and research, contributing to Taiwan's sustainable development. With continuous funds from the ATU project, NTU has the chance to enter the world's top universities.

2.4 Research Centers (Areas) Status Report:

After reviewing the implementation results of the university-level research centers under the ATU project and the forward-looking research projects, and based on NTU's mission and the future development needs of the country and society, we referred to NTU's 16 cutting-edge research fields listed in Table 1 and decided to focus on research fields in which the university has accumulated great research energy and has excelled globally or has a competitive edge internationally. The first five fields originate from the seven university-level research centers in Phase I. The former Research Center for Digital Humanities produced outstanding research results conducive to research in humanities, and has hence been merged into the Institute for Advanced Studies in Humanities and Social Sciences. The last five fields consist of Phase I ATU project teams which have demonstrated outstanding results and fields in which NTU is competitive internationally. The ten integrated, top-level research centers include the Institute for Advanced Studies in Humanities and Social Sciences, the Center for Information and Electronics Technologies, the Center of Genomic Medicine, the Center for Systems Biology, the Center for Neurobiology and Cognitive Science, the Center for Theoretical Sciences, the Center for Molecular Biomedical Imaging, the Center for Emerging Material and Advanced Component Technologies, the Center for Climate Change and Sustainable Development and the Center for Health Science and Intelligent Living.

2.5 Additional Information

2.5.1 Key Achievements

To become one of the world's top universities, NTU focuses not just on outstanding research, but also on an elite, streamlined administration as well as an improved administrative structure and resources management. All this is crucial to efficient university operation. To that effect, NTU has revised its constitution to shrink the size of the University Affairs Meeting from the original 379 delegates to just 170. To maintain a modern, e-based administration, NTU has introduced the ISO-9001 quality management system. Meanwhile, the International Academic Exchange Center was upgraded to the Office of International Affairs (OIA). On August 1, 2007, the University Financial Office was established. This Office takes charge of raising funds for research and teaching, campus construction and maintenance, and various engineering projects. It also manages the university funds. Through the Office, NTU has received an NT\$10 billion donation by the Yongling Foundation to build the NTU Cancer Hospital and the Proton Therapy Center. The project calls for the allocation of NT\$5 billion on a research program that links cancer therapy with biomedical engineering. The Office has also installed the Pai Hsien-yung Chair on Literature via funding donated by NTU alumnus Chief Cultural Executive Jenny Chang of Trend Micro. Quanta Technology's President Chee-Chun Leung, also an NTU alumnus, donated funds for the National Taiwan University Leung Center for Cosmology and Particle Astrophysics (LeCosPA).

2.5.2 Fund Use and Allocation

NTU receives financial assistance from the ROC Ministry of Education annually for its operating funds, while also benefiting from research subsidies offered by other relevant government institutions (such as the National Science Council, the Council for Agriculture, etc.) totaling approximately NT\$5.2 billion annually. Grants from juridical persons and private business entities average NT\$450 million per year. These financial assistance and commissioning expenses are mainly used to implement special research projects.

2.5.3 Alumni Contribution to Society

NTU has trained countless talents who make contributions to their own chosen fields around the world. In 2009 alone, 40 university presidents were NTU alumni, while 125 graduates of the university were research fellows at the Academia Sinica (31 in the Humanities, 43 in physics and mathematics, 51 in biological sciences, and one of whom was a Nobel Prize winner, and 15 of whom have become members of the US National Academy of Sciences).

2.5.4 Specialties of the University

I. Emphasis on Training of Future Leaders and Excellent teacher-and-Student Performance

NTU is the cradle of outstanding leaders in Taiwan and it therefore plays an important role in national development. For this reason, the university has always stressed the great importance of education. To attain its goals on training future leaders, NTU has devoted much effort and funds on teaching quality improvement. It has designed and offered the Leadership Program and Creative Entrepreneur Program, and revised to improve required courses in the Service Learning Program. The latter aims at making program participants combine their experiences in service with the more cognitive aspects in such a way that the significance of virtues is further internalized in the concept of service. The program has so far offered 834 related courses required for freshman to junior university students. To further make students acquire a wider vision and a more service-oriented view of life, and to make them keenly aware of their duties as citizen-ambassadors as they hone their leadership skills, NTU has linked the Service Learning Program with the school's efforts to train international and local volunteers, as well as social service teams. These efforts help encourage NTU students to participate in local and international service teams organized by the university as well as by other institutions.

II. Balanced Development and Priority Breakthrough

The university's efforts to promote the Top University Development Plan emphasize both balanced development and priority breakthrough. NTU's interdisciplinary integration is an edge when it comes to "Outstanding Research" by the fact that the university has 11 academic colleges and 2 specialized schools. They form an interdepartmental network with each discipline manned by excellent scholars with strong research capabilities. Through frequent interdisciplinary lunch meetings, NTU encourages professors from different fields to network and exchange experiences in a relaxed setting. Since 2006, several research teams have been spawned by these meetings, including one led by Prof. Chu Shih-yi—the Center for Quantum Science and Engineering (CQSE). This center, which links together professors in the fields of physics, electronics and engineering, is also on a cooperation plan with nVIDA. CQSE has commissioned Prof. Chuang Ming-tse to form the International Consultation Committee consisting of representatives from the Colleges of Electrical Engineering and Computer Science, Engineering, Medicine, Science, and Bio-Resources and Agriculture. Other similar projects include the Center for Systems and Synthetic Biology, New Energy Center, Health Sciences Research Center, INSIGHT Center, and the Center for Ethics, Law and Society in Biomedicine and Technology.

III. Dynamic Participation and Global Vision

On top of its efforts towards internationalization, NTU has launched the drive for Top University Development Plan. This has enhanced the international exposure of the university and thus facilitates its participation in international organizations and their related activities.

IV. International Recognition of the Academic Body

NTU's successful efforts to get better recognized in the international academic community can be seen in the number of NTU graduates forming part of local and international science and engineering national academies, and their positions in editorial boards of prestigious international journals.

3. Performance Indicators and Target Values (Overall and Annual Goals)

3.1 Goals for the Second Phase Top University Development Program (Using UIUC as Reference University and Aiming at the World's Top 50 Universities List)

In this second phase, NTU has adopted the University of Illinois at Urbana-Champaign as our reference university in our goal to make it to the Top 50 list. Strategically, continuing the spirit of the first phase, NTU will continue taking the completion of excellent infrastructure as its major goal, including the establishment of excellent research centers necessary to make the university an international-caliber research institution. Through NTU's core values and emphasis on balanced development and priority breakthrough, we intend to integrate and solidify the university's many internationally competitive areas, employ world-class academics, and promote transformative research. It is hoped that by riding on the wave of the first phase and taking advantage of the experiences we have accumulated, we can attain short-term goals on the number of journal paper publications, with assistance from funding obtained through the second phase. Only so can NTU be assured to achieve establishment of the 10 Top Research Center in the next five years, and only so can NTU join the ranks of the world's top universities at the shortest time possible (Please see Figure 5).

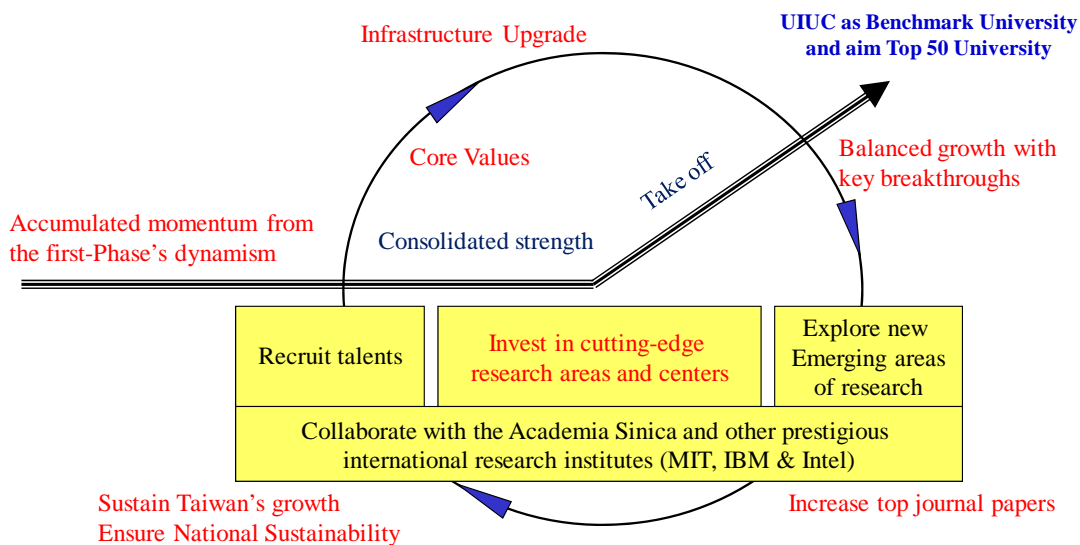


Figure 5 Establishing university-level research centers to trigger a flywheel effect to accelerate the journey to top university

3.2 Performance Indicators and Target Values for Annual Goals of the Second Phase Top University Development Program

It is the goal of this plan that after 5 years, NTU will be a university with top quality facilities and academic professionals conducting excellent research. (Please see Table 4)

Table 4 Performance Indicators for the Top University Development Plan

Academic			
International Ranking, Academic Status	World Class research center	After 5 years, the 10 Top research Centers will reach world standards; the ranking in terms of journal paper publication in 10 areas will enter the Top 50. The 10 areas will have an HiCi score of more than 30 publications.	
	International ranking	Global ranking among the Top 50 by Shanghai Jiaotong University, The London Times and the Higher Education Evaluation Center.	
Scientific Research Achievements	HiCi Number of Journal Articles	600 after 5 years	
	HiCi Number of Authors	15 more HiCi authors after 5 years	
Internationalization			
Number of International Professors	Recruitment of foreign fulltime professors	No.	20 additions per year
	Recruitment of foreign researchers	No.	50 additions per year
No. of Professors	Fulltime who are Members of Taiwan Academies	4 additions every 5 years	
	Fulltime who are Members of Foreign Academies	2 additions every 5 years	
	Fulltime who are Members of Important Societies	50 additions every 5 years	
Teaching Internationalization	No. of All-English Degree-Granting Programs	20 programs within 5 years	
	No. of Degree-Granting Programs with English-speaking Professors to Assist Foreign Students	60 programs within 5 years	
	Courses Taught in English	70 additions per year	
International Exchange	Sister Universities	There are currently 768. We aim for a 3% growth each year, while stressing quality. Well-known universities as our goal.	
	Exchange Student Plan	There are 224 now. We expect 5% growth annually.	
	Dual (Joint) Degree Plans	There are 34 now. We target a 3% annual growth.	

International Exchange	Dual (Joint) Students	Outbound	Average of 5 every year. We target a 15% growth after 5 years.
		Inbound	About 15 per year now. We target a 15% growth after 5 years.
	Exchange Students Number	Outbound	There are currently 401 students. NTU has set a study abroad (including short visits) goal for 1/3 of undergraduate students. Our goal is to increase the number to 900 after 5 years.
		Inbound	There are now 518 students. NTU has set a principle of balance. Our goal is to increase the number to 900 after 5 years.
	Short-term Students (Practicum, short-term research, summer courses)	Outbound	There are now 105 students. Short-term visits have been included among NTU's target of 1/3 of its undergraduates to study abroad. The goal is to reach 400 students after 5 years.
		Inbound	There are currently 138 students. With the introduction of summer courses, we expect to reach 400 after 5 years.
	Increasing short-term research, or exchange teaching, in overseas universities or research institutions		30 per year
	Cooperation plans with top overseas universities or research institutions		50 cases in 5 years
	Joint establishment of research centers with foreign partners		3 cases in 5 years
	Industry-Academia Cooperation		
Achievements in Industry-Academia Cooperation (increasing non-governmental, industry-academia cooperation funds)		Over NT\$550 million per year	
No. of patents		150 granted patents per year (100 for Taiwan ; 50 for Overseas).	
Patent R&D achievements		Attainment of NT\$120 million after 5 years (annual increase of 3%)	
Other issues (This shall be set by the university itself and approved by this evaluation committee. The following is a list of recommendations made by evaluation committee members)			
Assisting industry and Concrete plans for University and social development	<ol style="list-style-type: none"> 1. Industry-academia cooperation of 130 cases per year. 2. Training of personnel and increasing job opportunities made possible by industry-academia cooperation: 35 per year. 3. Technology transfer of 40 cases each year. 4. Creation of new companies through technology transfer: 15 in 5 years 5. NTU has already established the Northern Taiwan Teaching and Learning Resource Center. This calls for the gradual opening of the university's academic resources, and the offering of summer basic courses to satisfy teaching needs of different schools. This plan also calls for NTU to assist 5 schools that have not obtained the Towards Excellence and Academic Excellence subsidies in improving their academic systems with the goal of their compliance with evaluation requirements and eventually, being granted the said subsidies. 		

Teaching Excellence	<p>1. Improving teaching space, facilities and equipment</p> <p>(1) Construction of school buildings Completion of Teaching Hall 1, with the addition of 7 large-size lecture rooms, 22 small-size classrooms and 2 computer-teaching rooms. Furthermore, there is a need to plan for the construction of 2 more teaching halls to solve problems of lack of teaching space.</p> <p>(2) Improvement of teaching equipment and facilities.</p> <p>2. Assessment and Improvement of Curriculum Structure</p> <p>(1) Completion of the analysis and improvement of curriculum structures in 11 colleges.</p> <p>(2) Completion of the assessment of curriculum maps of all teaching units, with the goal of linking up education goals, the necessary students' core competence and curricula structure, so as to better meet changes in the environment and satisfy student training needs.</p> <p>3. Promotion of and planning for deep-bowl curriculum to upgrade curriculum quality.</p> <p>4. Continued improvement of students' "learning portfolio" system to improve student learning efficiency.</p> <p>5. Completion of faculties' "teaching portfolio" system to better assist faculties in preparing their teaching materials and thus upgrade teaching quality.</p> <p>6. Continued implementation of the teacher evaluation system, and orient it towards learning results as basis of assessment.</p>	
Upgrading Academic Power	Training young scholars to become famous international scholars	Addition of 10 per year
	Mentoring young faculties and scholars	Promoting the Research Career Project and Flying Pian's Plan
Training of International Research Talents	Training young scholars to obtain language skills related to their top research areas	80 per year
	Sending excellent faculties and scholars to foreign Top Universities or research institutions for studies or academic cooperation or for obtaining academic degrees.	100 per year
	Assisting foreign top research institutions to set up branches in Taiwan to carry out research	3 in 5 years
	Employment of foreign employees or research personnel	100 per year
Training of Excellent Talents with Leadership Qualities	Graduates of professional areas who enter related industries	About 5,600 per year
	Training in newly-rising or key industries, or for university departments	About 4,000 per year

	<p>Training of medium-to-high level talents for key or newly-rising industries and their measures</p>	<p>Measure: The University has offered across a range of programs including postgraduated programs, EMBA and the continuing professional development, as well as on-line open courses/extension education to help train the upper-level personnel for the national key development and emerging industries/entrepreneurs. Quantity: about 2000 per year.</p>
	<p>Degree of contribution to industry or social development</p>	<p>According to CHEERS magazine surveys, National Taiwan University graduates are the company's favorite employees for the last 3 consecutive years. This fact may reflect the human capital of school contribution. The University will continue this objective.</p>
	<p>Assisting students from indigent families to get enrolled (such as increasing number of scholarship grants by 10%, offering needy student tuition grants and other programs targeted at financially deprived students)</p>	<p>Without increasing the total number of university undergraduate students and students can adapt the principles of academic pressure, the moderate increase of Multi-Stars program students; 50 disabled students enrolled each year, about 20 Aboriginal enrollment each year.</p>

4. Strategies for Attaining Goals

In Taiwan, the creation of environment for university education and research requires overall operations similar to that of a modernized city. It is no longer what the National Science Council used to promote in the past in which excellent research grants given to a handful of research centers could propel a university into becoming a world-class institution. If a university cannot totally make long-term planning and organizational restructuring, while at the same time completing a basic structure for excellent teaching and research, then it can never attract world-class talents. Like a modern city, it requires not just having a skyscraper like the 101 Building to turn it into a world-class city and to attract tourists from all over the world. Instead, it calls for the city to improve its overall

culture and infrastructure. Thus, in this second phase, NTU intends to attract world-class talents and to continue creating an excellent locale for teaching and research, including the establishment of top research centers. By pinpointing prognostic and innovative research goals, NTU wishes to create top-quality results for its faculties and students as its ultimate goal.

4.1 Strategies for Attaining Goals on Top University Development Program

Based on the university’s medium-range academic development plan, we will continue strategies taken in the first phase. It means continued improvement of our learning and research environment, and massive increases in the quantity and quality of journal paper publication to reach Top University levels. We will integrate and fortify our existing advantage areas and establish a university-level research platform. It is hoped that the latter could expand on campus such that in five years, NTU will have 10 world-class research centers and 20-30 world-level research areas. In 5 to 10 years time, we hope to make it to the Top 100 world university ranking compiled by Shanghai Jiaotong University. The overall goal is to become a top international research-type university as illustrated in Figure 6. Thus, in this phase of the project, we will put more emphasis on international research cooperation plans and the training of outstanding young scholars on campus. Through the 10 research centers’ cooperation with Academia Sinica, well-known overseas research institutions and universities, or by means of joint establishment of research centers, we hope to put NTU professors’ research activities on the international platform.

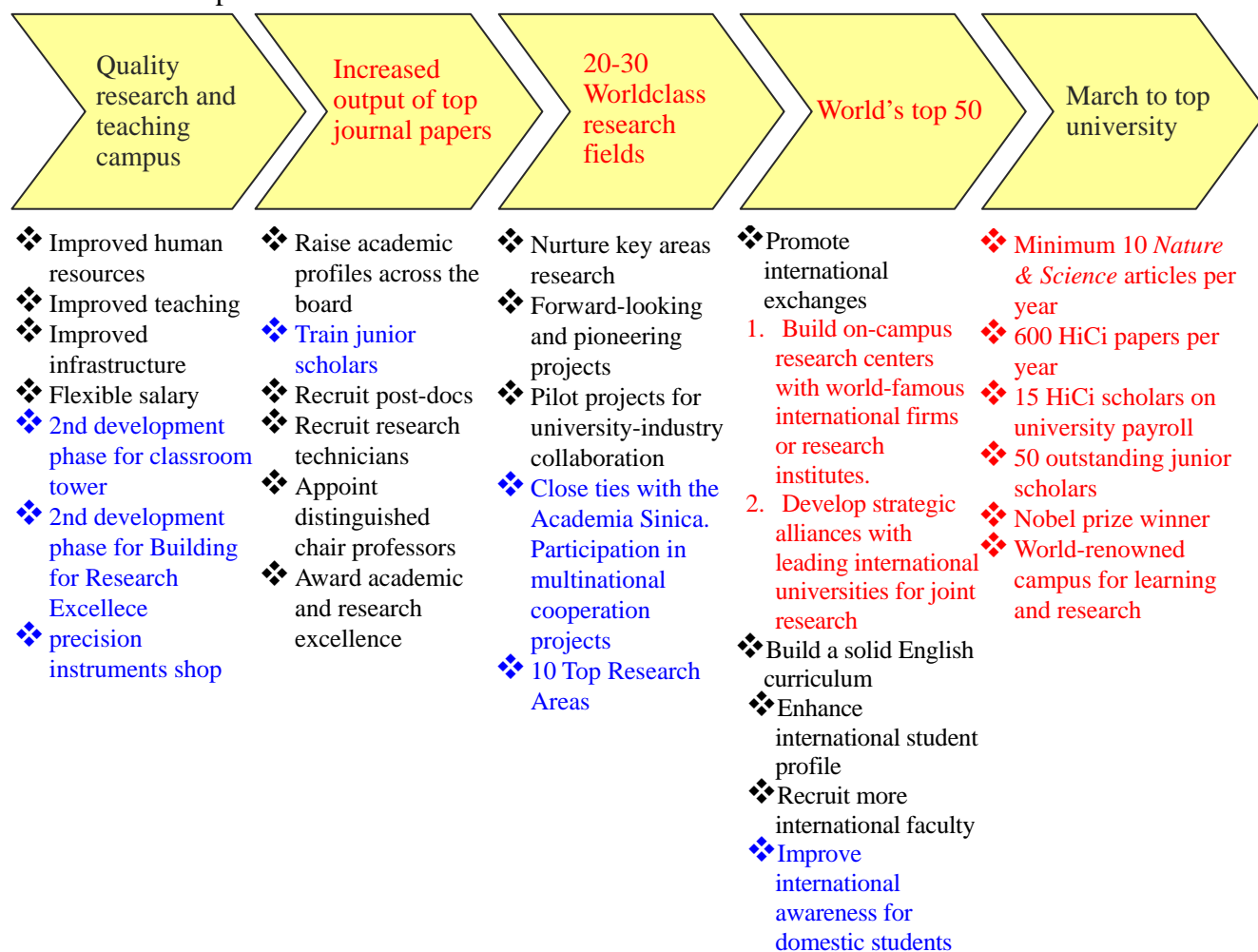


Figure 6 Overall Objectives and Strategy for the March to Top University

4.2 Operation Strategies and Organizational-Operational Adjustments: Concrete Plans

Based on the overall Top University Goals, NTU will continue the first-phase's five major strategies, as follows: Outstanding education through diversified learning, recruitment of teaching and research professors, fortifying infrastructure and software, outstanding and prognostic research, and academic internationalization. The goal is to create an excellent environment for study and research. Relevant measures will be pushed, which, when combined with this project's 10 top research center platforms, will help train our students into outstanding leaders in society and knowledgeable, innovative entrepreneurs (See Figure 7).

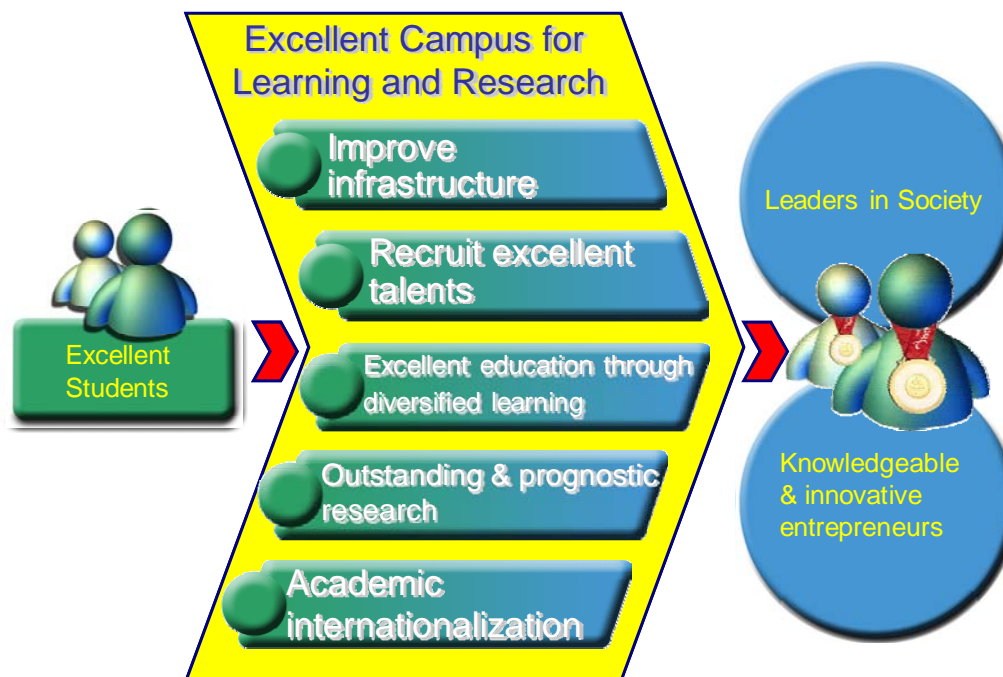


Figure 7 From Excellent Students to Social Elites

4.3 Strengthen Teaching and Research Capabilities and Measures for Training Interdisciplinary Talents

As technology, politics and society evolve rapidly, manpower requirements have also changed in the 21st Century. Interdisciplinary learning, international vista and informational sophistication are the key to competitiveness in the future. To better train new-generation future leaders and hone their competitive skills, NTU has adopted several measures aimed at teaching excellence.

4.3.1 Improvement in Curriculum Quality

I. Improvement and Fine Tuning of the Quality and Quantity of General Courses

NTU's general education excels in its equal emphasis on localization and international vision. It stresses tradition and also, modernity, in pursuing its mission of educating new-generation students of the 21st Century. In 2007, NTU launched the new general education system in which the 'core courses and areas' model divides general courses into eight categories, namely: literature & arts, history, world civilization, philosophy & ethics, civic consciousness & social analysis, quantitative analysis & mathematics, material sciences and life sciences. This mode reflects development in the said areas, and thus, gives general education a more balanced proportion.

NTU has completed designing of its curriculum based on the eight course categories, thus allowing a clearer regulation and setting of goals for its general education. The next goal will be to observe if all general courses meet goals set for each category, and those that fail to do so will be adjusted. This will assure that courses offered meet their goals. Further supervision of each semester's general courses will be made while new courses are designed and offered to students. At the same time, the university will observe the knowledge load of each of these courses and will require inclusion of student self-learning aspects in general courses.

Furthermore, to gain from the experiences of excellent general courses instructors and to better share university resources with society, NTU is now in the process of planning the publication of relevant books and teaching materials on general education authored by senior faculties, as well as the adoption of Open Course Ware. The contents of general courses, lecture outlines and other information will be made available online as a way of sharing with the general public.

II. Improvement of Language Education

In terms of Chinese Literature teaching, NTU has adopted the following strategies: (1) Integration and emphasis of core knowledge, (2) Use of online technology to attract active student learning, (3) Language competence testing and teaching according to levels, (4) reading list for classics and improvement in reading and writing training. All these are necessary to improve teaching. In terms of the English language, emphasis will be on improving facilities for audiovisual education, improving contents of the English Self-Learning Center, acquisition of educational software and installation of foreign language learning websites. NTU will also expand the types of language courses, with the goal of offering courses for 25 languages.

As a way to upgrade graduate students' English competence, the university has completed the installation of a graduate student online English learning system, which has 6 levels. Students may learn and complete their homework online, while three times each semester, they undergo written tests that help monitor their progress and achievements. Furthermore, NTU has established the Academic Writing Education Center, which offers three levels of writing classes. We hope to get enough funding to allow offering of more classes, and train graduate students, notably in teaching doctoral students how to write properly in English.

III. Improvement of Basic Science Core Curriculum and Experiments

Basic science core curricula include mathematics, physics, chemistry, biology and statistics. We expect to make improvements in the following ways: (1) Train and organize teaching assistants to assist in teaching, (2) Improve teaching auxiliary tools, (3) Renew facilities and internet equipment in classrooms and laboratories, and (4) Renew teaching materials.

IV. Improvement of Professional Curricula

NTU offers an expansive system of professional curricula. With budget consideration in mind, NTU will grant funding for professional curricula based on reasonableness of budget allocation and feasibility of actual plans. Subsidy items may include assignment of teaching assistants, teaching

equipment and tools, production of multimedia teaching materials, etc. In the first phase, 483 subsidy grants were given out. In the future, more funding will be allocated for improvement of professional courses.

V. Promotion of Degree-granting and Credit Curricula

In response to the rise of new academic fields and national needs, NTU offers interdisciplinary degree-granting and credit curricula to give students more opportunities for interdisciplinary studies. Currently, the university offers a total of 40 credit curricula, including the Leadership Program and the Creative Entrepreneurship Program. NTU will continue to design degree-granting and credit curricula based on student needs (such as a cloud computing program). Through these curricula, the university also hopes to speed up integration of some departments and graduate schools.

4.3.2 Measures for Improving Teaching Quality

I. Stronger Functions for the Center of Teaching and Learning Development

Since its establishment in May 2006, the center has launched several operations aimed at teaching improvement. In the future, this center will expand its service scope to cover faculties in universities located in Northern Taiwan. Cooperation can be done by providing services they need for teaching and with the involvement of auxiliary units in Northern Taiwan.

II. Promoting Operations of the Multimedia Production Center

This center will continue meeting on campus needs for audiovisual teaching materials, improving quality of those materials, training creative personnel, promoting industry-academia cooperation and exchanges, maintaining the center's equipment and offering better-quality services.

III. Promoting Minor and Double Degree Programs

In keeping with the NTU Method for Taking a Minor Degree and the NTU Method for Double Degree, the university allows students to take courses from different departments with the goal of interdisciplinary studies, exchange and integration. Currently, the approval rate for student applications for minor or double degree has reached 45%. This shows that interdisciplinary learning is becoming popular on campus. In the future, NTU will further allow more students to apply for these degree systems.

IV. Continuing to Promote Teaching Evaluation

NTU has since 1996 implemented the NTU Curriculum Evaluation Method, in which students make their evaluation online at the end of each semester. Student involvement grew from the initial 31% to more than 70%. Evaluation values (1 to 5) improved from the initial 3.6 to the current 4.2. Courses rated 4.0 and above improved from the initial 18.78% to the current 70% or higher. Those rate 3.0 and below dropped from 8.73% to the current 0.35%. These figures show that course evaluation has led to results. In the future, the current system will be continued, while a learning results-oriented course evaluation is promoted to further improve teaching efficiency.

V. Implementation of a Teaching Assistant System

For better teaching quality and in line with NTU's promotion of the concept of "teaching in big classes and discussion in smaller one", the university has set the Implementation Guidelines for the Teaching Assistant System. Here, 'teaching assistant' refers to graduate students who assist faculties in class by taking charge of group discussion and group experiments as well as marking student assignments. Currently, some 1,000 TAs are hired each school year. This will be expanded in the future to assist faculties in improving teaching quality.

VI. Total Improvement of Teaching Space and Facilities

NTU is an old university. Many school buildings and facilities are old. The continued rise in enrollment has made these facilities insufficient to meet teaching needs. Thus, the university has launched maintenance of the New Student Building, the Kungtong Classrooms and the Ordinary Classrooms (including installation of computer equipment, repair of desks, air-conditioning, etc.). The new Teaching Hall is under construction and will be completed by the end of 2010. Currently, NTU is planning the Second Phase of the Teaching Hall, which will eventually solve the problem of insufficient teaching space.

VII. Other Measures

NTU is planning to launch more measures aimed at improving teaching quality, such as the already installed Campus Curricula Map and Student Learning Roadmap File. In the future, contents of these measures will be improved. The Faculties' Teaching Roadmap, currently underway, will soon be completed through the availability of ample funds. This will soon be promoted among the faculty and student body, so as to help attain goals on quality of teaching and learning.

4.3.3 Morals Education and Social Concern

Under the guidance of President Lee, NTU has emphasized moral education through cultivation of students' virtues and concern for society. In 2006, the MOE awarded NTU with the Excellence in Moral Education Citation. In the future, the following will be promoted: (1) Leaders cultivation plan, (2) Sound learning in a sound campus, and (3) Service learning curricula.

4.4 Recruitment of Excellent Foreign Talents and Retaining Locals

NTU's faculty and student body have always been chosen from among the best in Taiwan. Currently, there are 1,967 fulltime faculties, 88% of whom hold a doctorate degree, and 96% have a rank of at least assistant professor. However, NTU still takes the recruitment of excellent faculty as its first mission in the road towards excellence. NTU has always adopted relevant strategies and policies (Please see 4.4.3 and 4.4.5). In the future, 20 foreign fulltime professors will be recruited each year.

4.4.1 Promoting the NTU Special Chair System

Important research is often inspired by discussions with prestigious scholars and the latter often serve as the core power behind the formation of excellent research teams. Teams led by such scholars also offer the most inspiring and student-drawing courses in universities. They also lead to important research achievements. For this reason, the recruitment of world-class scholars is an initial step in upgrading academic standing. NTU has set up the Special Chair System to facilitate invitation of

Nobel Prize winners, academy members of advanced countries, and world-prestigious scholars to come and give speeches and to lend a hand in research supervision. The said chair is of two types: The Research Chair and the Professorial Chair. In the future, this mechanism will be continued to upgrade NTU's teaching and research quality.

4.4.2 Other Measures for Recruiting Outstanding Faculties and Research Personnel

Among the many relevant measures are: (1) In addition to the on-campus three-level, three-reviews system, NTU has also established the Operation Pointers for the Employment of Fulltime Faculties, designed to assure quality of newly-recruited faculties and their compliance with university development goals, (2) Assistance to faculty members on the education of their children, (3) Promotion of naturalization of foreigners with fields of expertise or the lifting of controls on their period of work stay, as well as their quota, so as to encourage their long-term stay in Taiwan, (4) Promotion of all kinds of relevant measures aimed at upgrading and encouraging research, such as the Methods for Granting Incentives to Academic Research Achievements, (5) NTU has established the Pointers for Hiring Technicians as Faculties, and Operation Pointers for Hiring Special-Plan Faculties and Research Personnel. All these are seen as necessary to better meet teaching and research needs in the university. These measures will be continued in the second phase.

4.4.3 Fortifying the Current Professorial Chair System

NTU has a Professorial Chair System in place. However, lack of funding in the past has limited the number of such chairs, and thus has greatly reduced effects. After obtaining grants from the The Aim for the Top University Project, NTU has started recruiting world-class teaching and research personnel to achieve academic and research improvement, both in terms of quality and quantity. Furthermore, NTU has also initiated fundraising and preparatory work for sustainable funding and has expanded recruitment of local and international outstanding scholars to hold NTU professorial chairs, or to remain in their teaching positions at NTU.

4.4.4 Setting a Flexible Faculties' Salary System

Based on the Ministry of Education draft proposal "Implementation of a Flexible Salary System for Recruiting or Retaining and Special Talents", NTU is studying the possibility of adopting relevant flexible salary regulations. An ad hoc committee has been set up to study this measure and it has come up with draft proposals for regulating salaries of existing and newly recruited faculty, revised the Guidelines for Remuneration of Specially hired Professors and the Regulations for Establishing a Professorial Chair. On July 30, 2010, the university filed an official *Ren*-designated Letter No. 0990032256 with the MOE and has since integrated related regulations to authorize a set of guidelines for such flexible remuneration schemes. These guidelines were subsequently approved by the Executive Committee. In the future, this system will be well utilized to allow NTU's recruitment of international scholars.

4.4.5 Setting a Special Fund for the Employment of Faculties and Research Personnel

Due to stringent limitations or regulations on the funding of employment of new faculties and research personnel, and the difficulty of grasping such elusive opportunities to recruit, NTU has set up a university affairs special fund, together with a system of operation, to facilitate its flexible and conditional use by all university units. This fund allows ample grasp of hiring opportunities for the university.

4.4.6 System for Assisting New Faculties in Conducting Research

Building a Top University requires not just the recruitment of excellent faculties, but also the provision of necessary assistance to help new recruits stand on their feet, carry out research, join or build their own research teams and thus, work to attain prestige. All units applying for the recruitment of new faculties are required to submit a long-term development plan covering research spacing, funding, graduate students, mentor program or participation in research teams for the new recruit. In 2006, NTU established the NTU Top University Development Program Operation Guidelines for Subsidizing New Faculties' Additional Remuneration, the NTU Top University Development Program Operation Guidelines for New Faculties' International Academic Exchange Expenses, and the NTU Top University Development Program Operation Guidelines for New Faculties' Academic Research Projects, all to encourage newly recruited faculties to carry out teaching and research work.

4.4.7 Measures for Assisting Faculties in Solving Housing Problems

To help recruit local and foreign faculties and to assist them solve housing problems, NTU has for many years worked on its housing proposal, which was finally approved by the Executive Yuan and the MEC. NTU obtained loans for the building of a scholars' dormitory right in Taipei's prime district. Moreover, to attract foreign faculties to come to Taiwan, NTU has, in the first phase of the Program, pushed for the building of a faculties' dorm in four lots at No. 2, Lane 47, Yung kang Street, with a total of 59 housing units. The construction plan was submitted for approval to the MOE and a letter was sent to the Executive Yuan on August 7, 2007 for the final approval. In the second phase, Stage 2 of the dorm construction will be initiated. An additional 31 units will be built.

4.4.8 Other Measures to Attract Foreign Experts

A top university must be able to attract a large number of foreign faculties. In this project, a series of measures aimed at attracting foreign faculties will be introduced. For instance, various programs will be initiated to create an English-speaking environment on campus, such as the adoption of bilingual websites, documents, road signs etc. These methods are seen as means for increasing exchanges among local and foreign faculties and to make the latter feel at home in Taiwan. NTU's foreign faculties and research personnel (including fulltime, chair and part-time) increased from 2005's 74 persons to 177 in 2006. In 2007, there were 181; 204 in 2008 and 226 in 2009.

4.4.9 Flexible Teaching Load System to Encourage Research

NTU now has a very flexible teaching load waver system to better encourage faculties to carry out research. However, owing to a high teacher-student ratio, faculties are required to teach more courses to the detriment of their research work. In the future, more faculties will be hired, and when the ratio comes down, the flexibility will be further enhanced.

4.4.10 Strict Evaluation of Faculties and Research Personnel and the Imposition of an Elimination System

In January 1998, NTU established the NTU Faculties' Evaluation Standards. It was revised in October 2004. The strict rules stipulate that all fulltime salaried faculties, excluding those exempted, are to undergo evaluation once every 3 to 5 years. Evaluation of non-salaried faculties is subject to decisions made by their respective colleges and departments. Those who fail evaluations receive

assistance through college mediation with departments, and are re-evaluated after 1 to 2 years by the college. Those who still fail are eliminated, through decision by the Faculties' Evaluation Committee, by non-extension or termination of employment. The said evaluation standards allow colleges to set their own strict evaluation and elimination systems. In the future, NTU will continue to improve faculties' evaluation systems of the university and those adopted by departments. Elimination will be strictly enforced to assure upgrading of faculty qualification.

4.5 Balanced Development in the Humanities and Sciences

For NTU to become a first-class university, in addition to meeting certain standards in terms of average research performance, it must also obtain outstanding research results. NTU places great emphasis on both "achieving excellence" and "laying a solid foundation." This conviction is demonstrated by achieving "balanced development and breakthroughs in key areas." "Achieving excellence" means selecting research teams with great potential to become first-class in the world and providing them with priority support. The goal is to develop 20 to 30 world-class fields within the next five years. "Laying a solid foundation" means locating bottlenecks in the colleges, departments and institutes whose development is limited due to insufficient resources, then providing the necessary resources to remove these bottlenecks and elevate research standards. Advancement in the humanities and social sciences as well as research developments in forward-looking emerging fields and in industry-university cooperation are vital to NTU's pursuit of "research excellence." In terms of improving research quality, NTU will implement improvement measures which are detailed as follows.

4.5.1 Project to Enhance Development in the Humanities and Social Sciences

NTU is a comprehensive university where the development of the humanities and social sciences and that of science and engineering have always achieved a good balance. Among the university's 11 colleges, four are dedicated to the humanities and social sciences and seven focus on science and engineering. Among NTU's 1,974 faculty members, 536 teach in the fields of the humanities and social sciences, while 1,438 teach in the science and engineering fields. Among the 18 projects conducted by NTU under the MOE's Program for Promoting Academic Excellence of Universities and the NSC's Phase II of the said academic excellence promotion program, six are in the domain of the humanities and social sciences, while 12 focus on science and engineering. These figures illustrate NTU's balance between the development of the humanities and social sciences and that of sciences and engineering. In the past, as a result of severe shortage of resources, NTU had to devote more resources to science and engineering in order to actively promote development in these fields. Nevertheless, the university has striven to develop the humanities and social sciences fields in recent years. To support this endeavor, guidelines such as "NTU Guidelines for the Enhancement of Academic Excellence in the Humanities and Social Sciences" and "NTU Subsidy Guidelines for the Enhancement of Academic Quality of Journals in the Humanities and Social Sciences" were stipulated. The Humanities Building and the Social Sciences Building will be built. The College of Arts will be set up. Basic courses, academic programs and forums which are designed based on technological integration with a goal of promoting "holistic education" have been offered to cultivate students' capacity in the humanities, promote research of teaching methods in emerging critical fields such as creative management and corporate ethics, as well as promote research of teaching methods in the science of law based on the humanities.

4.5.2 Library Collection Development and Database Construction

Moreover, as NTU plays an important role in the history of Taiwan and in the academic development of the humanities and social sciences, it continues to increase the size of its library collection in the humanities and social sciences. Works in the humanities and the social sciences account for 74% of NTU's entire library collection. The library continues to acquire additional volumes in these two fields at an average rate of 145,000 items per year, accounting for 80% of the university's annual library collection acquisition quota. About 60% of the funding for data construction under the "Library Enhancement Project" of the ATU Project is allocated under the humanities and social sciences category, with an emphasis on collections of "Taiwan's cultural and historical data," "featured database" and "local histories," in the hope of building up NTU's unique library collection. In addition, as an alternative source of funds backing up the NSC-funded Library Collection Acquisition Project, the university's Library Enhancement Project provides funding to match the shortage of funds for faculty members who have received partial funds from the NSC.

4.5.3 Improvements in Teaching and Research Manpower

Measures to support teaching and research include: (1) Hiring additional part-time teachers to offer language courses in southeast Asian languages, French, German, Spanish and Russian; (2) Offering an academic program in "Asian Arts"; (3) Inviting overseas scholars to teach at NTU or offer courses jointly with the university's faculty in the humanities and social sciences colleges in order to foster students' international competitiveness; and (4) Hiring part-time teachers to give regular faculty more time and energy for research.

4.5.4 Establishing a "New Hundred Schools of Thought Forum"

The mission of the "New Hundred Schools of Thought Forum" is to promote the new Chinese culture being cultivated in Taiwan. The intended pupils of the forum are students from all over the world interested in learning more about Chinese culture. The content of the courses includes various speeches and books in both Chinese and English, which can be distributed via electronic media. The mission and format of the forum distinguish itself from the "Confucius Institute" in Mainland China.

In the next five years, the "New Hundred Schools of Thought Forum" plans to invite one hundred distinguished speakers, most of whom will be scholars in the humanities and social sciences, to each give one lecture on the diversified and new Chinese culture in Taiwan. Their talks will be recorded and made into one hundred DVDs. The contents of their lectures will also be compiled into 10 to 15 illustrated books that will be published in both Chinese and English. We believe this endeavor will help to summarize what Taiwan has achieved over the past 60 years and will serve the purpose of showcasing Taiwan's soft power and raising our national profile on the global stage.

4.5.5 Assisting the Development of Colleges in the Humanities and Social Sciences

The university will provide key assistance to the College of Liberal Arts, the College of the Social Sciences, the College of Management and the College of Law, in accordance with their respective development plans.

4.5.6 Plan to Lay the Foundation for Balanced Development

The No. 1 goal of NTU's ATU Project is to achieve comprehensive enhancement in all academic fields. The university already has a solid base in every academic domain. The goal of comprehensive

enhancement in all fields means wide-ranging improvements in the university's existing teaching and research system, including at 11 colleges, 54 departments, 103 graduate institutes (among them, 91 offer Ph.D. degree programs; 100 offer M.A. degree programs) and 42 interdisciplinary programs across colleges, departments and institutes. All colleges, departments and institutes mentioned here have completed extensive planning and proposed their development strategies, key directions and visions, as well as concrete plans to enhance teaching and research.

At the end of each year, the university makes official requests to all its colleges asking them to submit reports on completion results as well as detailed proposals for the coming year. A review committee examines the reports, with the committee's opinions serving as a basis for future funding decisions. In addition to senior NTU officers, members outside of the university are also asked to sit on the review committee, in order to ensure that the deliberations are conducted fairly and judiciously.

I. Development Strategies and Key Directions of the College of Liberal Arts

Established in 1928, the College of Liberal Arts enjoys the longest history in National Taiwan University. Our research ranges from humanities to social science and, in recent years, extends to fine arts, showing a high level of vitality. We are renowned for our solid tradition, rich variety and sophisticated research, thus leading other similar colleges in the nation. Some of our researchers are already among top of the world. We will encourage these outstanding colleagues to achieve excellence, and those who own potential will be supported to develop their own feature research.

Three strategies are designed to reach our goal. First, we will conduct extensive interdisciplinary research programs on Asia-Pacific cultures. Second, we plan to offer more foreign language courses, 25 kinds expected. Last, we will continue to develop the interaction between humanities and digital technology. Meanwhile, more chair professors, guest professors and post-doc researchers will be invited to energize our research capacity. More foreign faculty will be recruited, and the number of international students will be expanded. We will send more faculty and students to study abroad, expecting to catch up with the trend of globalization.

II. Development Strategies and Key Directions of the College of Science

The College of Science has established a successful foundation for its continuous pursuit of academic excellence. In the teaching aspect, we keep improving existing academic programs and also encouraging faculty members to offer interdisciplinary programs such as nanotechnology, marine technology law, meteorology communications, biochemistry and biological physics. To cultivate superior leadership, we design and develop new talent through special counseling methods and multiple-disciplinary learning models.

The College has also established a strong research foundation and is now building on that foundation to meet global development trends. In the basic sciences, our focus is on theoretical science, functional materials, molecular architecture and imaging technology, high-energy physics, astrophysics and cosmology, mental science, and green chemistry. In the earth sciences, the programs have been emphasized on seismology, tectonics and environmental change, typhoon and monsoon studies, marine science and environmental changes. Our research main stream covers empirical, theoretical and experimental methods, which are the three pillars of scientific discovery. The integration of these developing areas will be achieved in the a basic science park based around the buildings of "the Center for condensed matter", "Shih-Liang Hall", "mathematics", and "chemistry", and an earth sciences park

combining earth science, geography and geology. These integrations of disciplines will be the key to developing the world-wide leadership in these fields and raising our international profile. Certainly, this will greatly strengthen cross-college cooperation. In particular it will also reinforce our cooperation with the Academia Sinica and international research centers. Through these activities, we are on the track to reach our goal of becoming a top-rank international university.

III. Development Strategies and Key Directions of the College of Social Sciences

The college of Social Sciences is aimed to fully display the characteristics of a diversified portfolio. On the one hand, we will conduct researches with Taiwan unique characteristics at international academic area; on the other hand, we strengthen to communicate with the world with international ability. The main focuses of developing directions include: Globalization, East Asian Democratization and Regional Researches.

Globalization means economic, political and social globalization; East Asian Demarcation is researching influence of the East Asian democratization on the world; regional researches, except the study of indigenous Taiwan researches, focus on researches about Mainland China. In addition, strategies includes publishing books of China Studies, holding international seminars, establishing an platform for international cooperative China researches, organizing a strong researching group to teach a China development Program , in order to make the college of Social Sciences become as an international research center.

Moreover, we will develop social science theory, practical and policy operative approaches so practice and policy is fully supported by the theory and feed back to the society. In order to accomplish those goals, we will actively promote a variety of integrated research projects via exchange and cooperation. Specific measures including interdisciplinary faculty and interdisciplinary cross-faculty and cross-university will be adopted to diversify the content of the field and construct the international research network. Besides we will quickly complete the construction of the new Social Sciences building and in order to move back to the main campus in the near future. The College of Social Sciences will be tightly integrated with National Taiwan University and will become an international famous college of Social Sciences.

IV. Development Strategies and Key Directions of the College of Medicine

In the future, the development priorities of NTUCM in the field of research and education will focus on “genomic medicine”, “cancer” and “infection sickness”. The medical science has entered into “Post-Genomic Era today” . Through the regulation and interaction of gene and protein, human body can grow and develop to carry out the physiological function. However, diseases will also go with the abnormalities of gene and protein.

The research will focus on “cancer” and “infection sickness” in the future. Using the latest knowledge and technology from genomic medicine, we can solve the important disease questions in our compatriots. For example, from the viewpoint of genomic, infection sickness due to a pathogen genomic break into human body, correlate with human’s genomic and bring into effect. Therefor, it will become a new and necessary direction to do research with an aspect from genomic.

According to the above description, the strategy of development in NTUCM will build a core platforms base on NTU Center of Genomic Medicine to support genomic research of “cancer” and “infection sickness”. Besides, will establish “Clinical Genomics” , “Oncology” and “Brain and Mind

Sciences” of emerging graduate institutes in other developing research projects such as neuroscience, genetic disease and stem cell, can also use this core platform and emerging graduate institutes to promote and accumulate the individual development before synchronization. In execution, to strengthen the sharing and cooperation between different units in school on one hand and to solicit outstanding talent in internal and overseas, to lead NTUCM for excellence in future on the other.

V. Development Strategies and Key Directions of the College of Engineering

COE has achieved premier in Asia in many fields like Earthquake Engineering, Mitochondrion Study, Colloid and Interface Science, Manufacturing Automation, Research and Development for Metal Materials, Ship Technology, Environmental Engineering and Microelectromechanical (MEMS) Systems, and stepped gradually to the top of the world. The future development direction aims not only at the continued promotion of traditional research standard in engineering, but also at the enhancement of advanced technology, including Precision Electro-mechanical, Display Technology, Nano Electro-mechanical, Optoelectronic Material, Biomedical Engineering, Smart Sensor System for Future Life Applications, Green Production Technology, and Energy Technology. The development strategy toward this direction has been set up and implemented. Integrated multi-discipline research programs have been developed through the collaboration among faculties and research manpower of COE. To encourage the substantial relationship with partner universities and to promote the advanced research programs with industries are also important tasks to be carried out to enhance the achievement of academic field. Besides, the shortage of research and teaching space has always been an obstacle of the development of COE; however, under the hard work of each Dean, COE has finally got the permission and subsidy from the Ministry of Education in 2009 to build up the new building of COE. Following this development strategy and direction, it is expected that COE will create a whole new feature, and achieve the goal of becoming one of the best universities in the world soon.

VI. Development Strategies and Key Directions of the College of Bio-Resources and Agriculture

Development Strategies of College of Bioresources and Agriculture including A. Reorganize the structure of the department/institute to increase it’s attraction and competitive ability ; B. Enhance teaching standards increasing the students’ ability in research and working ; C. Increase international competitive ability of students ; D. Increase teacher input and quality ; E. Train students to have the ability to integrate different fields and become leaders ; F: Increase collaboration with other research institutes ; G. Enhance Affiliated Organizations to support teaching and research along with providing services to the society. Key Goal of College of Bioresources and Agriculture contains A. Provide an excellent and international teaching environment to train leaders with professional technology and global vision. B. Provide an excellent research environment and expand research resources to produce results with vision and creativity. C. Integrate manpower from different fields to form corporative teams to expand research results. D. Provide novel technology on superior and safe agriculture production and storage, and improve strategy on marketing and sustainable development. E. Provide new knowledge and technology to enhance the industries of good, recreation, health and live.

VII. Development Strategies and Key Directions of the College of Management

The College of Management is committed to becoming one of the leading business schools in the Asian-Pacific region and ultimately attaining global recognition for its outstanding education and

innovative research. Continuously recruitment of talented faculties worldwide to reduce student to teacher ratio and to elevate the teaching quality is effort made in the aspect of faculty recruitment. An award system is in place to inspire faculty to produce publication in the world renowned journals to be influential in the academic research arena. In order to provide students with global business education, the College of Management offers English-taught Global MBA Program and will expand the program to English-taught bachelor degree program. More international students have been enrolled to the College to diversify the student body and more real-world case-based courses have been offered to nurture students to become future leaders. To promote intercultural understanding and further internationalize the NTU College of Management community, the College pursued international accreditation, developed College-Level Student Exchange Program and Double-Degree Program, and execute projects that stimulate teaching and learning.

The College is dedicated to maintaining its position at the forefront of both theoretical study and the application of knowledge. It aims to combine the resources of government, industry, and academics, to innovate the practice and enhance Taiwan's international competitiveness. By emphasizing these concepts, the College ensures that it will remain a leader in management education worldwide.

VIII. Development Strategies and Key Directions of the College of Public Health

The overarching aim of the College of Public Health, National Taiwan University, is to nurture leaders in public health and to create and translate knowledge to public policy to achieve the goal of health for all. Given that the health determinants cover the aspects of genetics, environments, behaviors, social organizations and institutions, future development of the College will be pursued in three core areas: (1) Foster interdisciplinary collaboration in the fields of molecular biology, genetics, epidemiology, biostatistics, and health behavior sciences to enhance research and practices in health promotion and prevention; (2) Advance science and technology for health hazards identification and exposure assessment in both individual and ecological environments to improve the validity of risk assessment, which further serves as the evidence base for environmental and occupational health policy; and (3) Conduct research and experiments on health system reforms, including health care quality and efficiency, long-term care system, national health insurance, health industry management, etc. Strategically, the College will strengthen the existing research centers, enhance the international health research center, promote intra-university and inter-university collaboration, and link up a wide range of social resources, to attain the goal of a world-class college of public health.

IX. Development Strategies and Key Directions of the College of Electrical Engineering and Computer Science

In keeping with the national goal to construct a knowledge economy, and to meet the industry demands for advanced R&D personnel, the College of Electrical Engineering and Computer Science will adopt a development strategy which considers both area specialization and interdisciplinary integration, and actively cultivate future leaders for industry and academia. In addition, the College will improve its teaching and research environments, with a view toward creating a fertile soil for breeding top talents in achieving breakthrough innovation. Aside from the continuation of course review and refurbishment, and the improvements of space and equipments, the College will adopt additional incentives and improved evaluation and promotion mechanisms to build a pluralistic value system of research (for example, to recognize top conference papers, highly cited or exposed papers, works which are innovative, interdisciplinary, substantial to the industry or highly recognized

internationally). In essence, the College will strive to keep proximity to the value system of research of the global community. The college will pay particular attention to major global issues (such as green energy, health care, disaster prevention, sustainable development, education and entertainment, etc.) and emerging technology trends (such as context awareness, cloud computing, bio-medical electronics and informatics, and social networks, etc.). In addition, the College will strengthen its exchange and cooperation with the world's top universities and leaders of global industry, while inviting internationally renowned scholars and experts to come to Taiwan to give lectures or to give instructions, thereby accelerating our goal toward internationalization.

X. Development Strategies and Key Directions of the College of Law

NTU College of Law is recognized as a well-established law school with prominent faculty, outstanding research and promising students. Faculty members have published a total of 199 books on various topics of law for the National Taiwan University Legal Studies Series.

In order to plan and launch diverse academic projects, NTU College of Law has established research centers and education resources centers of the following topics: Asian WTO and International Health Law and Policy, Law and Technology Ethics, Human Rights and Jurisprudence, Law and Society, Corporate and Financial Law, Policies of Environmental Sustainability and Legal Studies, European Union Law, Fiscal and Tax Law, Public Law, Fundamental Legal Studies, Civil Law, Commercial Law, and Criminal Justice. In recent years, the College has been actively enhancing its global presence by entering into exchange agreements with 27 law schools around the world. It is the College's long-term objective to focus its research and teaching on the review and reform of domestic laws. The College will continue to undertake this mission and make strong contribution to facilitate the development in legislation, the judiciary, administration and social services. Furthermore, the College will also engage in future exploration and discussion of newly-emergent issues that capture international attention, such as the globalization of financial and economic laws, constitutional government and human rights, and international trade- and economics-related regulations. Interdisciplinary topics, including law and public health, law and medicine, and ethics in science, that are closely related to other sciences are high on the agenda as well. The aspiration of NTU College of Law is to seek excellence not only in the domestic arena, but also in the international law community and to expand its credentials as a globally acknowledged academic institute of law.

XI. Development Strategies and Key Directions of the College of Life Science

The college of life science currently has two departments for undergraduate curriculum, six graduate institutes and one genome and systems biology degree program for graduate curriculum. The College of life science offers undergraduate majors that prepare the future biologists equipped with fundamental background in biology and biotechnology, and graduate majors that prepare the next generation scholars fulfilling the needs of academic and industrial employers. Our teaching emphasizes both microscopic and macroscopic systems covering molecular biology, developmental biology, biochemical metabolism, animal physiology, systems biology, structural biology, evolution biology, ecology and biotechnology. Particularly, the genome and systems biology degree program is devoted to promote the development of genomics, proteomics, glycomics, metabolomics, bioinformatics and bioimaging in Taiwan and educate future leaders in these fields. Overall the research focus in this colleges includes neurobiology and brain function, plant genomics, alternative energy sources, animal behaviors, genetics of model organisms, cell biology, developmental biology,

aquatic animals, ecology, evolution biology, biodiversity, applied microbiology, structural biology, chemical biology and drug discovery. To encourage multidisciplinary cooperation and accomplish excellence in research, we are determined to integrate research resources, to conduct research assessment, to establish integrated research centers and to continue support for core facilities for genomics, proteomics, metabolomics, bioinformatics, structural biology, biodiversity, experimental animals and plant green house.

4.6 Channels for Enrollment of Indigent Students and Related Measures

4.6.1 Concrete Plans for Enrollment Opportunities for Indigent Students

To take care of indigent students and achieving area balance, and in line with MOE's Multi-Star Plan for Enrollment, Enrollment of the Handicapped, and Admission of Aborigine Students, NTU offers the following channels:

I. Multi-Star Plan for Enrollment

Except for the School of Medicine, NTU's departments offer at least one slot for this plan. Based on either the "Sub-study group shared common norms" or the non-sub-study group modes, this offers easy admission for guided students or those recommended by their high schools.

II. Enrollment of the Disadvantaged Students

To admit disadvantaged students, NTU has applied to the MOE for subsidies on related equipment and services for the disadvantaged students, totaling NT\$60,000 per student, to help pay for hardware facilities needed by students. NTU has set a ratio of 1:100 in admitting disadvantaged students.

III. Admission of Aborigine Students

In line with MOE strategies, NTU admits aborigine students using the selection method.

4.6.2 Auxiliary Measures for Helping Indigent Students

The following measures help students continue their studies: Aborigine Student Scholarships, Student Secure Learning Measures, Hope Scholarship, Lixue Scholarship, Multi-Star Plan Student Guidance, Guidance for the Handicapped, 88 Flood Victims Student Assistance and Dr. Hsu Jane Hsiao Calamity Relief Scholarship.

4.7 Support for International Exchanges and Faculty/Student Study/Research Abroad

In the first phase, NTU has made considerable achievements in internationalization. In the second phase, we will continue the concept of integration and responsibility sharing. By emphasizing sustainability, we will put more attention to strategy, integration and service. The Office of International Affairs will break away from ordinary practice and set long-term strategies for international development. Approaches include the integration of campus resources, signing of sister university agreements, inviting international scholars, offering excellent student services and others to increase NTU's dynamic character and prestige in the international stage. In summary, the major tasks to be launched in the second phase will include the following:

4.7.1 Strengthening International Exchanges

NTU has established partner-relationships with 361 schools. In the future, in accordance with its strategic objective of positioning itself throughout the world, NTU will strengthen its exchanges with top universities worldwide. Examples of these exchanges include the collaboration project between NTU and MIT, NTU's participation in the EU's FP-7 program, and the school's becoming a part of the EU's Erasmus Mundus program. In addition to these, NTU will continue to participate actively in many other important international university organizations.

For international exchanges to be sustained, the university's basic infrastructure and administrative system must both be sound. Building on the foundations of the previous phase, the emphasis in the future will be on enhancing user-friendly website, establishing the Second Generation Electronic Database on International Exchanges, developing an Exchange Student On-line System, and so on. NTU has also created Eight Indicators whose fulfillment will signal that NTU has truly become an international university; and over the last five years more than 60 target objectives falling under the eight indicators have been gradually implemented. The completion of additional target objectives in the future, something NTU is determined to carry out, can serve as a further yardstick of progress. An "Indicator of the Internationalization of NTU Students" will also be drafted to reflect the point of view of the students.

4.7.2 Helping New Faculties and Researchers Participate in International Academic Exchanges

NTU has always paid great attention to the position of its researchers in international scholarship within the context of international scholarship. Through such measures as the "Subsidy Rules for Promotion of International Affairs under the NTU ATU Project" and the "Initial Expense Rules for New Faculty in International Academic Exchanges", NTU has been able to provide all its colleges with sufficient funds for international exchanges. Colleges are free to decide for themselves which particular areas of research they wish to emphasize, and the direction in which they wish to develop their international exchanges. The university also encourages promising new faculty to research abroad for short periods of time or to participate in trans-national research projects. Since these measures were implemented, they have proven to be successful in helping faculty take part in many cross-border cooperation projects. In 2009, the number of international exchanges amounted to 5,894. A total of 164 international conferences were held on campus in the same year. These and other figures are proof that NTU's faculty and researchers have consistently performed very well when it comes to participation in international exchanges.

The university will actively continue to raise the international profile and visibility of its new faculty and researchers. It will join hands with its partner schools and help its faculty participate in international research projects and international academic affairs. It will also encourage faculty to serve key roles (such as being Program Committee Chair, the General Chair, the Steering Committee Keynote Speaker, and so on) in all important international conferences. Finally, it will encourage faculty to become core members (such as President Awards Committee Chair, Editor-in-chief, Vice President for Publications, Fellow Selection Committee, and so on) of the most important academic organizations in the world.

4.7.3 Expanding Students' International Outlook and Promoting 1/3 Undergraduates to Study Abroad

In order to expand students' international outlook, NTU has set a goal of having 1/3 of its undergraduates study abroad within the next three to five years. This means roughly 1,300 students will be selected to study overseas every year. NTU's Study Abroad program has multiple definitions owing to the different features of each college and its students' special needs of their students. Study Abroad has four major channels, including studying in NTU's partner schools as exchange students, taking intensive summer courses overseas and transferring credits back to NTU after course completion, obtaining overseas internships recognized by students' respective colleges, and joining overseas service-learning tours. Studying abroad through the student exchange system with partner schools has been the most popular Study Abroad channel. NTU currently has about 194 agreements signed with 160 partner schools, which allows the university to send more than 1,000 students abroad annually. The 15 overseas summer programs at Oxford, Stanford and other universities also provide 250 opportunities for NTU students to travel overseas every year. For NTU to reach its goal of having 1/3 of its students study abroad every year, complimentary measures in curriculum design, student counseling and other areas are being drafted jointly by the Office of Academic Affairs, the Office of Student Affairs and all colleges and departments.

4.7.4 Attracting International Students and Promoting International Dual-Degree/Joint-Degree Programs

The number of international students has increased at a steady rate of 10% per year since the 2005/2006 academic year. NTU currently has nearly 3,000 international students, including 1,738 degree-pursuing students from 68 countries, 489 international exchange students, 31 visiting students, and 700 Chinese-learning students. To attract degree-pursuing students, NTU will encourage colleges and departments to open up to international students, and at the same time continue to promote the provision of professional courses for these students.

NTU has signed 35 dual-degree/joint-degree agreements, and will continue to encourage participation in key international educational cooperation projects. Such cooperation includes the participation of NTU's Graduate Institute of Photonics and Optoelectronics in the EU's Erasmus Mundus program, the joint development of a newly-established English program by NTU and prestigious universities in Belgium, the Netherlands and the UK. The NTU Graduate Institute of Linguistics and several other schools are also making inquiries into the possibility of offering joint degree programs with the EU's Erasmus Mundus.

4.7.5 Planning for an International Education Center, Providing a Sound Education to International Students

NTU has close to 3,000 international students at present. In the future, when the "1/3 Study Abroad" program is implemented, at least 1,000 exchange students are expected to study at NTU each year. In order to accommodate the inflow of such a great number of international students, NTU plans to establish a functional international education center that offers general education courses taught in English to international students. Examples of these courses include Mandarin, Taiwanese and Chinese

culture, history, sociology, economics, business, environmental protection, and biotechnology. The center's primary function is to satisfy the basic course needs of international students, and to relieve colleges and departments of the burden of planning courses for these students and of having to care for their needs. Since international students will need to take professional courses in their NTU colleges, they can still make friends with local students. And as most courses will be offered by the International Education Center, the risk of deterioration of teaching quality due to the inflow of international students can be averted.

In addition to planning for the international education center, since the implementation of Phase One of the ATU project, colleges and departments have been offering a good number of courses in English. A total of 939 courses were taught in English at NTU during the 2009/2010 academic year (the courses have been indexed for *Courses Taught in English* provided to partner schools). The number of all-English academic programs at NTU (including graduate-level programs which offer enough courses in English to satisfy minimum credits required for graduation) amounts to 33. NTU will continue its efforts to improve the quality of its courses taught in English.

4.8 Programs to Facilitate Development of Industry and Society

4.8.1 Establishing an Industry-University Cooperation System

NTU is a comprehensive university with a solid foundation in all academic fields. In the future, it will use this advantage to build a sound industry-university cooperation system. The university seeks to actively integrate the strengths of government, industry, academia, and the research community to enhance the professionalism and strengthen the organization of its research teams. NTU will create a sound environment for industry-university cooperation and utilize outstanding talent and top research and development capacity to develop innovative industries, help upgrade Taiwan's industrial competitiveness, boost economic development, and foster a sound and sustainable society.

To accomplish its mission of benefiting the nation and the people, NTU's primary objective is to build a comprehensive and highly efficient industry-university cooperation system. NTU will improve its effectiveness and create value out of industry-university cooperation by the following methods: adjusting and strengthening its organization and management teams, aligning organization platforms both on and off campus, integrating information concerning industry and intellectual property, establishing a complete Innovation Incubation System, providing legal services regarding intellectual property rights and compliance, and marketing intellectual property.



Figure 8 Overall Objectives of NTU's Industry-University Cooperation System

NTU's Industry-University Cooperation Center (formerly the Division of Technology Transfer and the Division of Industry-University Cooperation) under the Office of Research and Development expanded the scope of its operations starting in 2006. Besides implementing numerous projects, the center also proactively searched out and managed intellectual property owned by technology related colleges (including patent application, maintenance, marketing and technology transfer). The College of Law provided legal support regarding the management of various types of intellectual property.

4.8.2 Research Results of the Technology Mining Project

The aforementioned Innovation Incubation System, which began implementing the Technology Mining Project in 2004, consists of an on-campus Innovation Incubation Center and an off-campus Innovation Incubation Company. The project is the result of collaboration between the Industry-University Cooperation Center, NTU's designated unit in charge of industry-university cooperation, and the Innovation Incubation Company. Its mission includes assessing the value of intellectual property currently owned by NTU, selecting items with potential, assisting product packaging and marketing, and helping to incubate new industries. In terms of the incubation of new industries, faculties receive assistance in turning their research results into product prototypes. Since the innovation incubation system (as represented by the Center and Company) provides the necessary funding, it is also entitled to share or ownership of the new technology when it becomes profitable. Once the products are fully completed, they may be promoted, incorporated, or technology transferred to the industrial sector, and future profits will be shared by the incubation system, NTU, and the technology team. NTU established the Office of Financial Affairs on August 1, 2007, to take charge of the development and promotion of innovative businesses. The Office identifies NTU's patented technologies which possess market value, then seeks investment from the industrial sector, and develops innovative businesses together with the industrial sector while assuming a leading role in the businesses. One example is the "NTU Chinese" online tutorial software developed with support from the ATU Project over the past year. The software has been officially launched online in hopes that it will result in business opportunities, now that learning Chinese has become a popular pursuit worldwide. In the future, NTU will continue to generate similar successful cases.

4.8.3 Building Regional Teaching Resource Center to Assist Overall Regional Development

In order to help the development of neighboring universities, NTU has set up the "Second North Teaching Resource Center". In accordance with a previously established policy, NTU has also gradually given its partner schools access to various NTU teaching resources. Faculties and students of partner schools can freely access teaching resources, platforms, websites, books, information, speeches and courses. In total, the Center has 12 partner schools, with which NTU shares resources on 15 service platforms based on NTU's "Teacher's Growth Platform" and "Teaching Resource Sharing".

Of NTU's 12 partner schools, five still have not received subsidies from the ATU Project or from the Teaching Excellent Project. NTU has invited these 5 schools to design theme-based cooperation programs based on each school's needs or special circumstances. The four main themes are "Teaching Assistant System", "Curricula Building", "Tutoring Mechanism", and "Building a System for Developing Talent". Under these four themes are 18 subordinate themes. NTU hopes to introduce a

customized platform for mutual growth, contribute to creating an excellent environment that fosters advancements in teaching, and create campuses that can achieve sustainable growth.

4.8.4 Establishing the Outstanding Research Award to Promote Economic Development

The Outstanding Research Award has been established to encourage researchers to technology transfer their research or to set up new enterprises. To be eligible for the reward, candidates must meet one of the following criteria. (1) They have obtained patents for breakthrough technology that has potential market value or can be technology transferred. (2) They have developed a new technology at NTU and have set up an enterprise or have already successfully transferred their innovation into products. (3) They have devised a strategy or method that successfully allows innovation produced on campus to be used by the private sector, and have contributed to economic development of region or the nation either through their business partners or by virtue of some other relationship. Several Outstanding Research Awards are given out each year, a practice that will continue in the future.

4.8.5 Offering Interdisciplinary Entrepreneurship Programs of the Technology Industry

For the technology sector to be successful, good leadership with outstanding talent is essential. Taking advantage of the fact that NTU is a comprehensive university with some of the best students in Taiwan, NTU has attempted to cultivate technology sector leaders through its interdisciplinary courses. The university has also attempted to lay down a solid foundation for the nation's technology industry. The interdisciplinary entrepreneurship program is offered jointly by the College of Management, the College of Electrical Engineering and Computer Science, and the College of Engineering. The program teaches students from the College of Electrical Engineering and Computer and those from the College of Engineering such business skills as marketing, market information, and finance, all of which are necessary to start a business. At the same time, students of the College of Management can learn basic concepts relating to important new technologies. This interdisciplinary program can initiate students into business fundamentals; cultivate a new generation of leaders in the technology industry; and, by bringing together engineering and business students, can help to foster new relationships. It is hoped that the program can help engender future entrepreneurial teams in the technology industry. The program was implemented in February 2009.

4.8.6 Establishing an Industry-University Cooperation Research Park at NTU's Chubei Branch

In order to boost Taiwan's overall competitiveness, and in compliance with the government's funding policy, NTU raised funds and completed the construction of the Bizhen Building in its Chubei Branch for the purpose of industry-university cooperation at the end of 2009. NTU will integrate local resources with its own at the research park. Based on the development needs of different industries, NTU will set up research centers in fields such as biomedicine, biomedical electronics, bioinformatics, biochips, IC design, precision machinery, bioresources and agriculture. These centers will be used to develop and integrate researches in fields relating to biomedicine, bioagriculture, and cutting-edge technology. Teaching units and education promotion centers will also be established to cultivate individuals with talent in integrated technology and to increase the business management competency

of high-tech management personnel. At the same time, NTU will provide business owners with assistance and consultation regarding investment, incubation, management and technology, while the university will provide substantial support in space, manpower and equipment. It will also form industry-university cooperation strategic alliances with industries, and build a demonstration campus for industry-university cooperation. The guidelines were implemented in March 2010.

4.8.7 Establishing a Culture and Creative Center, Promoting Taiwan's Arts Industry

At the project's initial planning stage, NTU agrees to provide a 2.75-hectare large piece of land south of its campus proper, facing the intersection of Keelung and Roosevelt Roads. The plan is to renovate existing buildings with private investments, and to construct an arts center, a knowledge and innovation center (including space for industry-university cooperation and exchange), a parking lot and auxiliary facilities. Furthermore, to satisfy the need of NTU and its neighboring communities for a place to hold arts performances, a world-class arts performance building which can accommodate an audience of more than 1,000 will be built. The performance building will be capable of catering to the different needs of difference performance arts and interdisciplinary groups. The space will accommodate various performance forms, and could become a cultural landmark as famous as NTU. Industries will be invited to participate in the knowledge and innovation center; they can also conduct substantial exchanges with NTU directly through the sharing of equipment and manpower and will be given permission to use NTU's abundant technology resources (faculties, laboratories, intellectual property, research results, students, etc.). Through cooperation, these industries will provide NTU faculties and students with the space, funding and manpower for further research and development, which can then be applied to the technology industry. The knowledge and innovation center will integrate the operation of the existing innovation incubation system with industries' strength and flexibility as well as NTU's resources to build a mechanism creating wealth for both parties. Implementation of the project is scheduled to roll out in 2011.

4.9 Proposal for Establishing World-Class Research Center to Raise the International Ranking of NTU

4.9.1 Reorganizing NTU's Research Centers to Establish the University's Knowledge Triangle

A university has three responsibilities: teaching, research, and innovation (please see Fig.9). These three form what is known as the Knowledge Triangle (yellow lines), and functional, university-wide research centers form the core of this triangle. Here basic and applied research benefit each other through their mutual give-and-take. It is commonly understood that basic research is built on a foundation of high-level facilities, abundant resources, and other related services, all of which support the goal of basic research, which is to carry out the dissemination, exchange, and preservation of knowledge. The basic research centers now being established should be broad enough to include research clusters representing many different disciplines; they should provide a platform that allows research clusters an opportunity to interact with one another, while also giving them free rein to exploit their respective strengths. In this way the goal of promoting a campus-wide integration of research

across many disciplines can be advanced. Thus, as NTU tries to become one of the top universities in the world, it will be necessary to integrate and strengthen the fields in which NTU is competitive on an international level. The school will have to establish many different functional research centers that will form the core of its Knowledge Triangle. By means of the two proposals that follow, these centers will help NTU to develop in its pursuit of excellence. As these research centers will be the main components of the Knowledge Triangle, they can be divided broadly into two main categories: (1) Research centers in pursuit of scientific excellence. These must provide unique research services. They must be supportive of pioneering research and innovations in knowledge. They will need to consider the challenges of modern science and technology, and should strive to develop excellence in their researchers. These centers should be as challenging as possible and appeal to the younger generation professionally. (2) Supportive research centers. These centers provide support to research projects based on the steps chosen as well as the research service quality indicated in project proposals, thereby managing projects in a systematic way. These centers can connect researchers to members of the Advisory Committee for consultation and provide access to facilities. They can also effectively bridge research and innovation, and provide effective management.

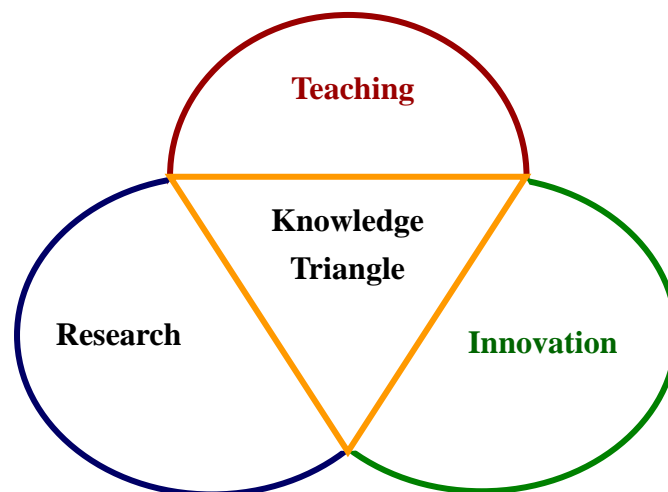


Figure 9 Research Centers Are Critical to the Knowledge Triangle

4.9.2 Building a Building for Research Excellence to Help the University’s Research Centers Carry out Interdisciplinary Research

The most influential inventions and discoveries were all made at the boundaries of various disciplines, and not within the disciplines themselves. In order to establish a new way of thinking at NTU, and to help give birth to new disciplines in science and engineering, the school will foster an environment conducive to transformative research. When it comes to ideas, the school will serve as a catalyst for change. It will encourage its faculty to challenge current knowledge, so that they can be encouraged to step onto the research front. To promote transformative research, it is necessary to provide an appropriate venue and space for doing so, one that will push colleagues to shatter the frontiers of knowledge. This venue should be one that will redefine research topics, research fields, and even the structure of research itself. In this way a new culture will be created on campus, and transdisciplinary research can flourish.

To achieve this goal, it will be necessary to finish the construction of the first and second phase of a Building for Research Excellence. Such a building will provide a space that can accommodate research centers for many different fields. Its goal will be to conduct pioneering research and to attract talented researchers. In addition, the building will also help solve the problem of outstanding senior research professors not having enough space. At the same time, it will also indicate whether an international collaborative research and development center is feasible. Such a center would help to form clusters and stimulate the talents of other researchers on campus, and induce them to conduct innovative research on their own. The establishment of the Building for Research Excellence is expected to help achieve the following functions and goals: **(1) Promoting communication among faculties; (2) Stimulating innovation among colleagues; (3) Creating diversity of viewpoints among researchers; (4) Fostering the conditions for unintended discoveries.**

4.9.3 Strengthening Facilities for Basic Research to Support Research at the University-Level Research Centers

I. University-level Fabrication Center

Microelectronics is one of the most important industries in Taiwan. It is also a field where NTU has the greatest competitive edge internationally. Thus it is necessary to build a university fabrication center, so that NTU's research endeavors can reach an even higher level and talented foreign researchers can be attracted to work in NTU. To achieve these aggressive objectives and establish an interdisciplinary research environment, NTU will also work together with National Applied Research Laboratories closely. This fabrication center will help integrate most important laboratories on NTU campus as well as their equipments. It will also provide the essential nano/micro fabrication facilities for both academic and industrial researches and developments. In addition, the establishment of this Fabrication Center will help the fusion of talents and skills in cross-disciplinary research fields. It integrates research capacities toward various top-level applied scientific fields, such as complementary metal-oxide-semiconductor (CMOS), Nano-Photonics and Nano-Energy technology, and Nano-Biomedical Researches. The major services offered in this center are user operations, fabrication orders, and professional/educational trainings. This provides the collaborative infrastructure in advanced fabrication facilities for northern part of Taiwan. As the consequence, this Fabrication Center, together with the Building for Research Excellence, will build an interdisciplinary and innovative research settlement for next generation scientific developments.

II. University-level Animal Research Center

The biotechnology industry will be one of the most important industries in Taiwan. In this regard, animal research is an indispensable tool of the biotech industry, and is playing an increasingly more critical role in transgenic research. A modern, university-wide animal laboratory center will not only make high-level research possible, it is also a symbol, of a top-notch university. During the first planning phase, it was decided that a campus-wide animal lab would be set up, but the problem of a shortage of funds for the lab's interiors still needs to be addressed urgently. We hope that more funds can be forthcoming during the next phase, so that the center's interiors can be completed, so that NTU's international competitiveness in the two fields described above can be raised.

III. University-level Precision Machinery Center

Breakthroughs in research often require the support of precision instruments, which are indispensable in a top-notch university.

4.9.4 Selecting and Strengthening NTU's Ten Top-Level Research Centers in Pursuit of Scientific Excellence

As NTU has various colleges and departments, it is convinced that “**intramural integration**” yields better results than “**intercollegiate integration**”. One of NTU's key development missions is to “**to boost the nation's economy and resolve key issues concerning humanity's sustainability**”. Having in mind society's sustainable development and the responsibility NTU bears for promoting social development as a first rate research university in a modernized nation, NTU has formulated five key themes for academic development:

(1) Refinement and preservation of cultural heritage, (2) Serious pursuit of basic academic subjects, (3) Lay the foundation for sustainable social development, (4) Develop knowledge economy and the technological industry, and (5) Promote health care and a healthy life style.

The project plans to build ten intramural interdisciplinary research centers based on these five key themes, taking into account the 16 competitive fields indicated in Table 1, as well as NTU's world-class, top-rate research centers and its internationally competitive academic fields (Please see 2.4 for details). The ten intramural interdisciplinary research centers will assume a leading role in NTU's ATU project. The focuses and development strategies of the ten research centers are:

I. Institute for Advanced Studies in Humanities and Social Sciences

The Institute is an extension of the Ministry of Education's “The Aim for the Top University Project”, and is the only research center dedicated to the field of humanities and social sciences in the country. With “East Asian Confucianism and Education” and “Education and Culture of Taiwan” as its primary research directions, the Institute will integrate on-campus and off-campus platforms, as well those belonging to domestic and international studies in the humanities and social sciences, to serve as a platform for East Asian studies. It will also enhance teaching and promote undergraduate degree programs to make NTU a powerhouse of Eastern Asian studies globally. Furthermore, the Institute will strengthen researches into topics relating to Taiwan and its development under globalization, under which studies of fundamental theories, as well as the long-term and international features of the technology integration orientation, will be conducted. Some key themes include: studies of economic globalization and the world trade system, organizational behavior, growth pattern and operations strategies in Chinese businesses under globalization, Chinese capital and the restructuring of economic space, and immigrants and Taiwan.

II. Center for Information and Electronics Technologies

The Center is one of NTU's four major research centers serving as an extension of the Ministry of Education's “The Aim for the Top University Project”. It will build key research teams and integrated laboratories based on macroscopic and forward-looking “integrated objectives” as well as

comprehensive evaluation and incentive systems, in order to strengthen integrated interdisciplinary research with other research centers and work closely with the industrial sector.

III. Center of Genomic Medicine

The Center is one of NTU's four major research centers serving as an extension of the Ministry of Education's "The Aim for the Top University Project". It builds a state-of-the-art platform for research in genomic medicine, provides core facilities and technical support, and will establish the Center for Cancer and Infectious Diseases in order to address serious diseases in Taiwan, present new treatment as well as prevention technologies and strategies.

IV. Center for Systems Biology

Established in June 2006, the Center's goal is to integrate resources across colleges in order to introduce the mathematical theories and computational principles of system science to the most advanced discussions in the fields of biomedicine and biotechnology, and consequently construct accurate quantitative analysis models for biological systems, which will facilitate a deeper understanding and grasp of the operations of complicated biological phenomena, and create space for advancement in biomedical and biotechnological research. The Center strives to promote NTU's research and education in the fields of life sciences in order to achieve world-class standards and to reach out to the biological industry.

V. Center for Neurobiology and Cognitive Science

Established in October 2006, the Center converges personnel and resources of NTU's relevant colleges and departments as well as the NTU Hospital and promotes integrated research from different levels of genetics, molecules, cells, systems, behavior, cognition, society, evolution, and computational simulations, thereby improving the standards of neurobiology and cognitive science in Taiwan, and promoting the development of neurology and psychiatry as well as the integration of engineering and intelligence. The Center's research topics include schizophrenia, perception and emotion, memory and language, chronic pain, and neurodegenerative diseases.

VI. Center for Theoretical Sciences

The Center will integrate NTU's existing outstanding theoretical science disciplines. NTU has long been the leader in theoretical sciences in the country, and over the past ten years, it has also achieved significant progress in the field of natural science. Some of NTU's projects in mathematics and physics have been considered cutting-edge internationally, and possess great potential to achieve major breakthroughs in the future. In addition, the Institute of Atomic and Molecular Sciences, the Institute of Mathematics, and the Institute of Astronomy and Astrophysics of Academia Sinica have all relocated to the NTU campus, and the National Center for Theoretical Sciences (North) is on campus as well. The Center for Theoretical Sciences will and should promote parallel linkage across different theoretical science disciplines, foster creativity and generate new interdisciplinary research directions, and create new synergies.

VII. Center for Molecular Biomedical Imaging

The center integrates state-of-the-art laboratories of imaging, molecular genetics, image development, molecular genetics of animal models and image analysis. It conducts education training as well as research and development of the new systems and new methods of molecular biomedical imaging. The Center also discusses and studies key topics such as gene expression, embryo development, cancer diagnosis and tracking, tissue apoptosis and death, and cerebral functions. The strategy of the Center is to leverage NTU's advantage of being a comprehensive university, and continue to develop research platforms. While strengthening existing interdisciplinary research in the basic sciences, the Center also develops and deepens translational research of medical imaging in the diagnosis of various diseases in order to best integrate research, education and clinical applications. The Center expects to become a world-class center of excellence in molecular biomedical imaging within the next five years.

VIII. Center for Emerging Materials and Advanced Devices

Using the original Center for Advanced Nano-Materials as its basis, the Center will integrate key research fields of the colleges of Science, Engineering, and Electrical Engineering and Computer Science, and will cover departments and institutes in the fields of chemistry, physics, materials science, chemical engineering, polymer science and engineering, mechanical engineering, electrical engineering, electronics engineering, and optoelectronics. The Center for Advanced Nano-Materials and the Center for Condensed Matter Sciences will form a world-class research team which develops the research and manufacturing of novel materials, builds the technology platform for advanced components, and cooperates with the government in assisting the development of semiconductors and optoelectronics in order to attain the goal for Taiwan to achieve sustainable development.

IX. Center for Climate Change and Sustainable Development

In the next five years, this newly integrated center will focus primarily on influence and contribution to the industry and social development of Taiwan, summary report of current resources and budget allocation, reducing greenhouse gas emissions, developing low-carbon energy, increasing energy efficiency, and developing intensive agriculture, fishing, and stock farming industries. In addition, the Center will design quantifiable benefit assessment measures for each policy and formulate strategies, build regional and global disaster prevention monitoring systems and improve capacity, as well as align with key domestic and overseas research institutes and industries to jointly develop integrated research based on two of the government's administrative goals: "green energy industry" and "intensive agriculture".

X. Center for Health Science and Intelligent Living

The new Center will integrate the Center for Research in the Health Industry and the Center of Innovation and Synergy for Intelligent Home and Living Technology. It will strive to converge the achievements and resources in Taiwan of projects related to healthcare and the intelligent living technology, and promote innovative research and development to discover unmet needs and upgrade industries.

4.9.5 Establishing Research Centers or Research Clusters to Serve as Platforms for Obtaining Funding from Other Sources

The majority of research projects at NTU receive their funding through government research funds. In order to increase alternative sources of funding, this project, with the top ten research centers or the research clusters under the ATU project as its core, will try actively to integrate interdisciplinary research. The method of Leverage Funding will encourage NTU to jointly hire faculty and researchers from other institutions, so that NTU can obtain a share of the research resources of the Industrial Technology Research Institute, the National Science Council, Academia Sinica, legal persons and the industrial sector. It will also cooperate with renowned academic institutions overseas or jointly set up research centers. In 2008, for example, NTU's New Energy Center signed a three-year, US\$4.5 million agreement with the King Abdullah University of Science and Technology (KAUST) in an international joint research project focused on Solar Building Technology. At the same time NTU has also established an Industry-University cooperation platform and a complete knowledge-industry chain.

4.9.6 Establishing a Mechanism to Identify Prospective Areas of Research—the Forward-looking Innovative Research Initiative

In addition to committing resources to the ten cutting-edge research centers and key areas of research, this project also tries to establish a mechanism to identify new trends in research to strengthen the foundation for scientific enquiry, to facilitate economic growth, and to offer solutions to sustainable human development. It focuses especially on potential topics in the six emerging sectors such as the wellness passport, refined agriculture, cultural innovation, etc., that have a regional importance (such as Avian flu). The project calls for an interdisciplinary team of outstanding NTU scientists working side-by-side international talents to strengthen the research basis for participation in off-shore projects. In addition, NTU will launch a series of "Forward-looking Innovative Research Initiatives," offering seed money to encourage the faculty and researchers to participate in emerging areas of research. Projected beginning date of this project is April 1, 2011.

4.9.7 Preliminary Procedures for Subsidizing and Promoting International Cooperation Projects

Faculties and researchers at NTU are encouraged to participate actively in exchanges with foreign academic institutions and with the private sector. They are encouraged to participate in international research projects carried out under the auspices of the National Science Council, and to participate in international research projects (such as the EU's FP7 program). To help fulfill these goals, NTU has stipulated the "Preliminary Guidelines for the Promotion of International Research Projects". All full-time NTU faculties and researchers that meet eligibility requirements for NSC projects can apply to participate in international research projects. To be considered, applicants must prepare a report describing preliminary plans for working with a well-known foreign institution. Their projects must also have been approved in a meeting by the college to which the applicants belong or by related colleges. After the applications have been submitted the school will consider their applications. These guidelines have been in place since February 2009.

4.9.8 Proposal to Nurture Outstanding Young Scholars: Promoting the Research Career Project

NTU intends to raise its prestige and international profile by having at least 50 articles published in Nature and Science within the next ten years and by promoting exponential growth in the number of articles published in top-tier academic journals. To reach these goals, the Research Career Project proposes sending 100 outstanding young scholars abroad annually to study with research teams under the direction of the three types of scholars: former Nobel Prize recipients, those with publications in Nature and Science, and those ranked No.1 in their respective fields, as judged by the number of articles published in leading journals dedicated to various specialties. In addition, to encourage NTU faculty to conduct long-term and original researches in important fields, so that their potential can be fully realized and they can reach positions of prominence in cutting-edge fields of science and technology, the university will also set up a research funding program to support outstanding NTU scholars. (This project is expected to take effect April 1, 2011).

4.9.9 Establishing Joint Research Centers with Prestigious International Academic Institutions to Promote International Research Collaboration

NTU already ranks top in the number of ESI (Essential Science Indicator) papers published in 16 fields. But unless this number is increased further through joint university-wide publication efforts, NTU still has a long way to go to become globally competitive and make a positive impact internationally. Participating in international projects will help NTU reach this goal. This project, therefore, calls for NTU's Top Ten Research Centers or the Leading Research Groups of individual colleges to conduct exchanges and joint ventures with the top twenty international universities on the Shanghai Jiao Tung University's list of world universities, as well as with the Academia Sinica or other world-famous research institutions. An example of such successful ventures is the joint research center with Intel to conduct cutting-edge experiments on machine-to-machine communication modules and technologies to maintain a leading position on information electronics research. NTU will assist individuals and teams to develop such joint projects with funding from both home and participating foreign institutions. Individuals or teams with National Science Council funding for bilateral projects with a foreign institution, or those who receive substantial funding from private industries to launch joint projects with well-established foreign universities, are particularly welcome. This project will become effective on Aug. 1, 2011. The goal is to establish five on-campus research centers within the next five years with leading foreign universities or research institutions as partners.

4.9.10 Elevating NTU's Overall Research Levels with the Ten University-Level Research Centers at the Core, Complemented by Balanced Development of the Eleven Colleges

I. Promoting the Development of Interdisciplinary Research Teams

The departments and institutes are the fundamental teaching and research units of NTU, and thus their performance has to be first-rate for NTU to be a top university. NTU will select some of its forward-looking research projects in the past, connect them to respective top-rate departments, institutes or emerging research fields to form interdisciplinary research teams. Each top-rate

department and institute must be ahead of their counterparts nation-wide. Moreover, they need to present data and facts indicating they are very close to achieving world-class status, and draft feasible plans aiming for the top in the shortest possible time. Departments such as the Department of Chinese Literature, the Department of Chemistry, the Department of Electrical Engineering, and some Departments under the College of Medicine are all good examples.

II. The Integrated System Encompassing Five Primary Concerns, Ten Top-Level Research Centers and the Interdisciplinary Research Teams

The ten top-level research centers, the Building for Research Excellence and the three research and development infrastructure facilities are all closely integrated under the five primary concerns, and form a complete system, where the top ten research centers are all linked to one another and complement one another in order to jointly reach the goal of the five primary concerns. At the same time, the departments and institutes of NTU's 11 colleges serve as the foundation for the respective integrated research centers. The balanced development of research projects is expected to generate rapid overall development of the university's academics. (Please see Fig.10 and Table 5)

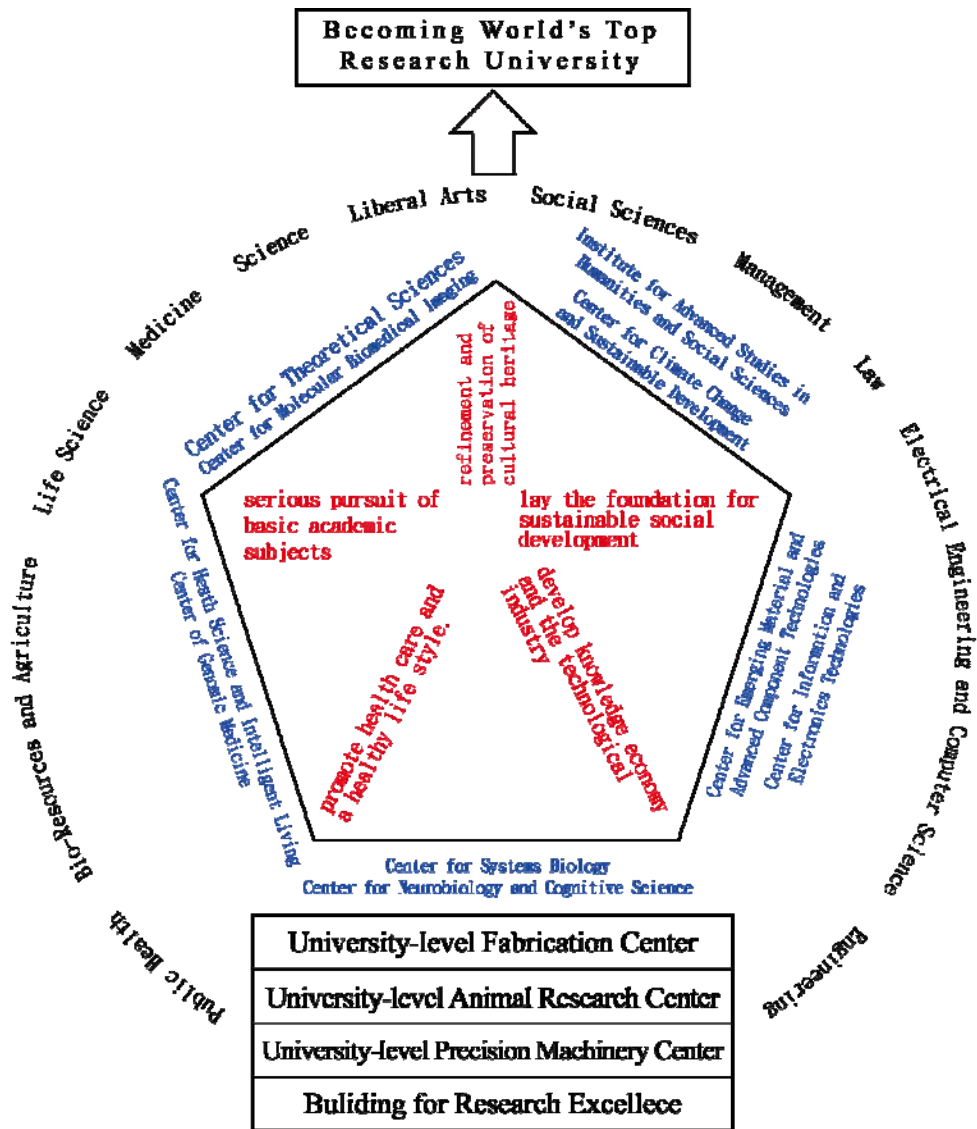


Figure 10 The Relationship between Five Primary Concerns, Top Ten Research Centers, and Eleven Colleges

Table 5 The Relationship between NTU’s Top Ten Research Centers and Its 11 Colleges

	Liberal Arts	Science	Social Sciences	Medicine	Engineering	Bio-Resources and Agriculture	Management	Public Health	Electrical Engineering and Computer Science	Law	Life Science
Institute for Advanced Studies in Humanities and Social Sciences	•	•	•				•	•	•	•	
Center for Information and Electronics Technologies	•	•		•	•				•		•
Center of Genomic Medicine		•		•	•	•		•	•		•
Center for Systems Biology		•		•		•		•	•		•
Center for Neurobiology and Cognitive Science	•	•	•	•		•		•	•		•
Center for Theoretical Sciences		•		•	•				•		
Center for Molecular Biomedical Imaging		•		•	•				•		•
Center for Emerging Material and Advanced Devices		•		•	•				•		
Center for Climate Change and Sustainable Development		•	•		•	•	•	•		•	•
Center for Health Science and Intelligent Living		•	•	•	•			•	•		

The research achievement status of many NTU departments and institutes has almost achieved top-level in Asia or the world. Taking this fact into consideration, in addition to promoting “intramural integration” of the ten top-level research centers, NTU plans to select departments and institutes having the most complete research teams and research results as well as possessing great development potential and importance to conduct interdisciplinary research and to push for excellence. Each project has to be ranked top in the country, and needs to present data proving it is close to world-class. A feasibility plan is then drafted indicating ways to reach the top in the shortest time possible. The departments and institutes surround the top ten research centers and serve as foundation for

development for the centers. These top-level departments and institutes can strive for excellence in their respective research fields and promote NTU's overall advancement. Once the government's funding is allocated, they can go all out to compete in Asia or the world, and obtain a spot in the international academic arena.

4.10 Measures and Strategies for Training Manpower Needed by Industries

To train talents needed by industries, NTU not only fortifies undergraduate education, but likewise exert efforts in training graduate students needed by the private sector. NTU once promoted the dual degree 5-year system (undergraduate + graduate studies). However, Article 23 of the University Law which stipulates that students must first complete their undergraduate studies before admission to graduate school, made that impossible to implement. Thus, the university adjusted the school system by relaxing the Academic Units Waver Method, and in so doing, allowed capable students still in their undergraduate to take graduate school courses which are credited once they enter graduate school. The old restriction of credited units not exceeding half of the graduation required units was lifted, thus allowing students to obtain graduate degrees in one year. In the future, NTU will recommend MOE to amend the University Law so that the said restrictions are lifted.

Moreover, to further train industry-needed manpower, NTU has offered the Creative Entrepreneurship Course and the Leadership Course, and has jointly launched a Design Program with Stanford University. It has also introduced many courses related to industry analysis and intellectual property rights, while at the same time promoting industry-academia cooperation plans. In 2009, industry-academia cooperation plans financed by businesses totaled 148 cases while those supported by the National Science Council numbered 47 cases. The implementation of industry-academia plans also helped train manpower needed by industries. In the future, NTU will continue offering related practical courses as it promotes more cooperation plans involving industry and academia.

4.11 Concrete Plans for Seeking and Integrating Resources from Outside the Campus

4.11.1 Sound Campus Infrastructure

For better research quality, there is a need to build a sound campus infrastructure. The criteria for such include: high-cost but for long-use purposes, excellent cost benefit during operations, shared by many, managed by professional technicians, and users' pay principle, etc. Among those planned belong to the following types: for processing use, computational, analysis and testing and auxiliary uses. They will be placed under the management of the Office of Research and Development to attain the goals of resource sharing.

The "NTU Management Methods for the Use of Expensive Gadgets" will be established, together with a relevant website for campus-wide online management of the said gadgets. A committee is now in the process of providing guidance to all university labs and research centers regarding the adoption of online standard operating procedures, and a system for lending out equipment and gadgets.

To better promote interdisciplinary research and in keeping with the goal to create excellent space for teaching and research, we will start planning for the Second Teaching Building, the NTU Humanities and Arts Lecture Hall and Faculties' Hall, the International Visitors' Dormitory, the 2nd Outstanding Research Building, the NTU Animal Research Center, the Processing Center and a Precision Machinery Plant.

4.11.2 Granting Appropriate Seed Funding for Prognostic, Pioneering and High-Risk Research

Many important research projects do not receive the necessary attention in the initial stages. In fact, scholars in relevant fields often cast a doubt on their feasibility and potentials for academic development. This is especially true in the case of prognostic, pioneering and high-risk research themes. NTU has already approved the Subsidy Guidelines for Prognostic Joint Industry-Academia Research Projects. Under this, researchers in all colleges submit proposals which would undergo a stringent review process carried out by foreign and local scholars. Those who pass receive seed funding for research to help their projects go past the pioneer and high-risk period and achieve initial results. After that, the relevant government grant unit can be approached for further support. This plan has been going on since August 1, 2006. In this second phase, the number of recipients will be expanded, and be only limited to younger scholars.

4.11.3 Mechanism for Speedy Promotion of Cooperation Research Team

Through the Top University Development Project, NTU realizes that in order to form a bigger number of cooperation research teams, it cannot solely rely on excellence projects such as those large projects initiated by the government and involving a small number of people. Instead, NTU has to adopt a working mechanism for the speedy promotion of cooperation research teams. In line with this, NTU has drafted the Operations Pointers for Subsidy of Advantage Areas in The Aim for the Top University Project. After stringent review by local and foreign scholars, 16 research teams with world-class research caliber were approved in 2006 and received university financial support. This coincided with the first phase plan for 16 research areas meeting world levels. In the future, the number of team projects will be expanded to meet the goals of ten world-class research centers, 20-30 advantage areas, and 600 HiCi journal papers.

4.11.4 Mechanism and Environment for Promoting Interdisciplinary Research

NTU's 11 colleges almost cover all academic fields. Besides, NTU has the best scholars in each field and the strongest research capabilities, making the university enjoy the potentials of interdisciplinary research. The successful development of interdisciplinary research is likely to become a crucial factor in NTU's path towards The Aim for the Top University Project. This explains why in the first phase, we have already established the mechanism and environment for interdisciplinary research teams. Efforts in this regard will be continued to further foment the formation of interdisciplinary research teams on campus.

4.11.5 Fortifying Manpower for Basic Research

Excellent research manpower is the first requirement for outstanding research. In mapping out NTU's plans for The Aim for the Top University Project, we have in 2006, established the Operations Pointers for Subsidy of Post-Doctoral and Technical Staff. This calls for the recruitment of post-doctorate and research staff to further support academic research. Since 2006, NTU has recruited 120 post-doctorate research personnel and 29 research technicians. In the future, more post-doctorate research personnel will be recruited, especially those coming from Europe and the US, all with the goal of beefing up NTU's research manpower and internationalization.

5. NTU Project Implementation Measures and Management and Control Mechanism

The reform measures of the project are diverse and abundant, and thus the resources and budget required for these measures are immense, and the execution procedures are complex and multi-layered. It is thus crucial to come up with an effective mechanism for the management and control of the implementation progress and for the evaluation of performance. The mechanism must be strictly enforced in order to ensure the smooth and effective execution of the overall project.

NTU established a rigorous tripartite implementation performance management and control mechanism as shown in Fig.11: each improvement measure or execution item listed in the proposal has an implementation unit and a supervision unit as its first two levels. The first tier is the implementation unit in charge of project execution. The second tier is the supervision unit in charge of the management and control of progress, budget and performance. There is a third tier implementation management and control and performance evaluation committee at the university level. In addition, an advisory committee at the university level, consisting of domestic and foreign scholars and professionals, is responsible for providing advice on project goals, content, expected results, resource allocation, and the plans of first tier implementation units.

Moreover, the “ATU Project Implementation Protocols” were passed in the administrative meeting outlining the annual planning timetable, content of the plan as well as implementation management and control and performance evaluation measures for first tier units.

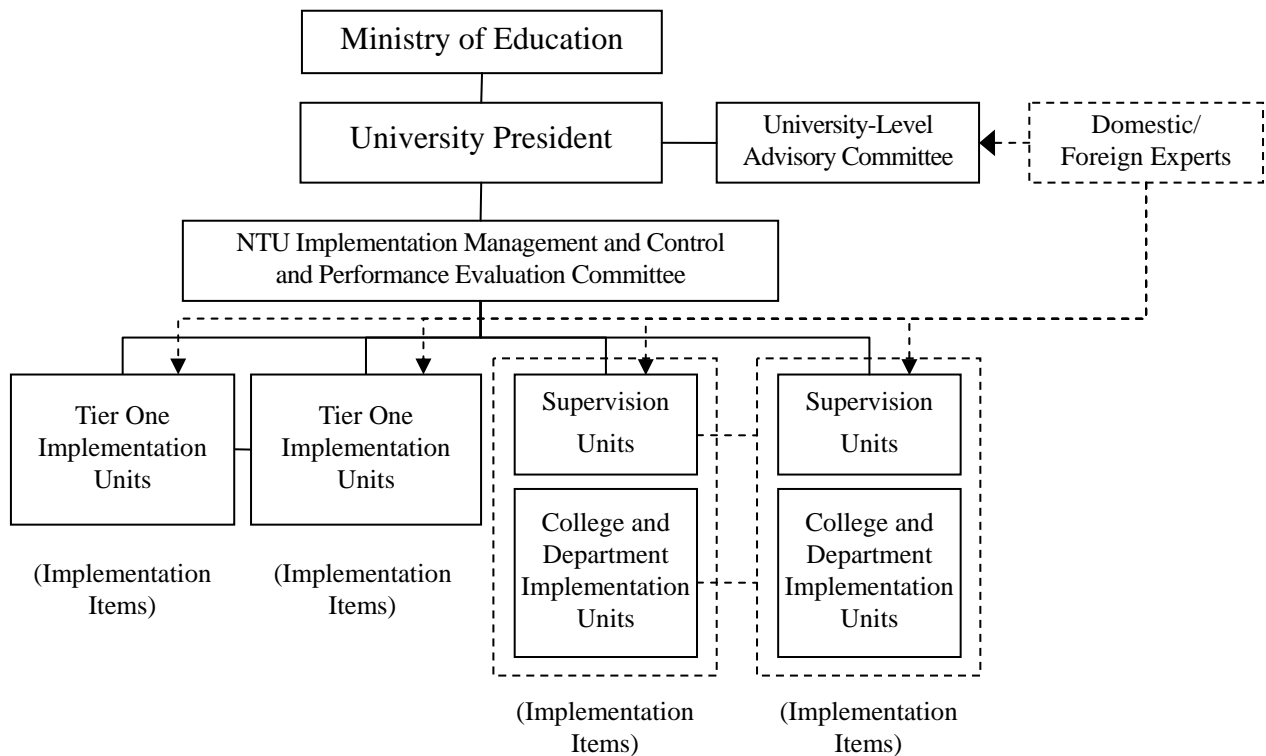


Figure 11 Tier Two and Three Implementation Performance Management and Control Mechanism

6. Project’s Overall Financial Planning, Budget Requested for Each Year, and the Expense Management and Control Mechanism

6.1 Budget Request Summary

Budget allocation is based on the project’s goals, such as accelerating internationalization, recruiting overseas talents and cultivating outstanding young scholars at home to satisfy the demands of industries and society, and elevating research and development capacity. The budget request is indicated in Table 6. The requested amount for each budget item shows an increase from that of the first phase. The sub-projects include the newly added HR structural improvement (such as salary flexibility), continuing to enhance teaching quality and constructing a quality environment (such as phase two instruction buildings and the Building for Research Excellence), promoting academic internationalization, developing key excellence research projects, and adding the sub-project of “Establishing Top-Level Cross-Border Research Centers and Facilitating International Research Cooperation” in order to strengthen international research cooperation projects, highlight the university’s cutting-edge research fields to build world-class research and development base, and accelerate the realization of NTU’s goal to become a first-rate university internationally.

Table 6 Budget Request for NTU’s “ATU Project” (Unit: NT\$1 million)

Sub-project	Year 2011	Year 2012	Year 2013	Year 2014	Year 2015	Total
HR Structural Improvement (including recruiting outstanding faculties, researchers, and increasing supporting manpower)	250	250	250	250	250	1,250
Upgrade Teaching-Related Measures	450	450	450	450	450	2,250
Infrastructure improvement (including comprehensive improvement of hardware for interdisciplinary teaching and research)	1,300	1,300	1,300	1,300	1,300	6,500
Liberal Arts Development Promotion Project	360	360	360	360	360	1,800
Full-Scale Academic Field Upgrade Project	450	450	450	450	450	2,250
Excellent Research Project	800	770	740	740	740	3,790
Funds required for Forward-Looking Navigator Research Project, the Research Career Project, and other measures to foster industry-university cooperation	455	455	455	455	455	2,275
Academic Internalization	200	200	200	200	200	1,000
Establish Top-Level Cross-Border Research Centers and Facilitate International Research Cooperation	190	220	250	250	250	1,160
Tactical Support of the University	45	45	45	45	45	225
Total	4,500	4,500	4,500	4,500	4,500	22,500

6.2 Overview of the University Income Fund; Income Sources Aside from MOE Subsidies; and How the Various Sources of Income are Used and Distributed

The University Income Fund includes funding for the university as well as income generated by four entities: the Experiment Farm affiliated to the College of Bioresources and Agriculture, the Experimental Forest affiliated to the College of Bioresources and Agriculture, the Highland Experimental Farm, and the NTU Animal Hospital. For total income in 2009 (excluding funding for the ATU project), please see Table 7. The top three sources of revenue are the Practicum Agreement Income, the MOE Subsidy, Practicum Agreement Income, and the Tuition and Miscellaneous Income. Total income from the three sources amounted to NT\$12.35 billion, accounting for 83.70% of the University Income Fund. Of the Tuition and Miscellaneous Income, 23.5% was used for student activities and prize money. The remainder was used to make up for deficits in Teaching and Research Personnel Costs, in Teaching and Disciplinary expenses, and other basic expenditures. As to the Practicum Income Fund, it is an important source of income apart from the MOE subsidy. It derives from income generated when the school's colleges, departments, institutes and research centers undertake projects or provide academic and technical services for academic and technical projects on behalf of various governmental agencies, the private sector, civil groups, research institutions, and so on. It also derives from other income related to the practicum cooperation. In 2009, the Practicum Income Fund was NT\$6.012 billion, accounting for 40.75 % of the University Income Fund. **While the Practicum Income Fund is used to pay for various project implementation expenditures, the management fee portion deducted from the Fund is collectively appropriated by the university to cover expenses such as personnel management, utilities, etc. Balance from individual projects will be used to fund teaching and research development. In addition, NTU runs an aggressive fund-raising campaign to support innovative ideas in teaching and research as well as to construct new buildings and maintain older ones for a better prospect filled with new ventures.**

NTU and six other universities in Taiwan have formed a league titled "The University League headed by NTU". This league has actively asked for the European Commission to help support the establishment of the "European Union Centre in Taiwan" to be built on the NTU campus. The center has now received 1.1 million Euros for its first phase of operations, which will last for four years. NTU will receive 36 percent of this amount, totaling 396,000 Euros spread out evenly over four years.

With regards to other self-generated income (for example, extension education income, property use and rights income, and so on), the rules are as follows: A certain portion is to be deducted by the University make up for the deficit resulting from insufficient MOE subsidy funding. After this portion has been spent, whatever self-generated income remains can be used by individual colleges, departments, institutes, centers and the like to pay for their respective expenditures relating to education promotion, venue rental fees, utility bills, specified donation recipients, and so on, in accordance with regulations. With additional funding from the second round of the MOE's Worldclass University Initiative, NTU stands a much better chance to gain fast entry into the exclusive club of the world's best 50 universities.

Table 7 Sources of Income for NTU (Unit: NT\$1,000)

Item	2009 Budget Allocation	Ratio Against Total Income
University Fund Income (current income and capital income)		
MOE Subsidy	4,657,901	31.57%
Tuition and Miscellaneous Income	1,679,661	11.38%
Practicum Agreement Income	6,012,406	40.75%
Education Promotion Income	235,671	1.60%
Property Use and Rights Income	727,561	4.93%
Donations	198,035	1.34%
Investment Surplus	16,505	0.11%
Subsidy from Other Government Agencies	294,801	2.00%
Other Sources (Balance from affiliated business operations, Entrance Examination Fees, Interest Earnings...)	739,719	5.01%
Experimental Forest National Soil Revitalization Plan	192,600	1.31%
Total	14,754,860	100.00%

Note: 2009 Budget allocation excludes funding from the ATU project

6.3 Mechanism for Expense Control and Management

In order to implement the ATU project, NTU has stipulated the “ATU Project Implementation Protocols”. According to these guidelines, tier-one implementation units are required to submit proposals based on annual budget funding allocation guidelines. The proposals should address topics such as: project objectives, implementation strategies, execution timetable, funds required, implementation management and control mechanisms, performance evaluation mechanisms, and so on. After reading the proposals, the NTU Advisory Committee will determine priority as to how funds are to be allocated. Implementation units must submit annual reports to the ATU Implementation Management and Control and Performance Evaluation Committee (referred to as “the Committee” hereafter). If necessary, implementation units will be required to give a presentation of their achievements. The Committee will evaluate the implementation units on the basis of their annual reports and presentations, and use these as the basis for deciding funding allocation in the future.

7. Sustainable Operation—Strategies and Measures

A world-class university needs to find ways to sustain its operations. Government commitment of funds and resources is more of a need-based nature and must not be counted on indefinitely. NTU has already built into its plans sustainable funds foundations and all sorts of fund-raising mechanisms. These include technology transfers, patent authorizations, technological incubations, and industrial partnerships such as knowledge and innovation parks, industrial parks, extension education, distance learning and online programs, the NTU knowledge center, the university hospital, and experimental farms and forests. In addition, NTU alumni are a potential worldwide asset. In the future NTU will tap into this important link for online fund raising and support for sustainable operations.

In recent years, NTU has aggressively pursued the goal of sustainability. Key measures include 1) setting up an Operation and Management Task Force under the General Affairs Department, hiring management specialists from the faculty and experienced alumni from the business sector to help tap into hidden campus resources and maximize the use of current facilities to improve revenue; 2) using the BOT model together with fund raising and taking out loans to build and renovate university housing and dorm facilities, restaurants, parking garages, and guest houses. Successful examples include the on-campus Leader Hotel, the 2nd Student Activities Center, the Xitou Restaurant and Hotel complex, the Luming Tang Food Court, the BOT dorms, and the underground parking garage on Hsinsheng S. Road; and 3) Mandating a cost-sharing scheme for new campus constructions. All resident units must share the cost of new department buildings. This has a positive effect on alumni fund raising.

Since Fiscal Year 1996, when the University Fund was established, NTU has significantly increased the percentage of privately-raised funds from 20% in 1996 to 66.95% in 2006 and 72.54% in 2010. Several modern new buildings were donated by alumni and private business, including the Leader Hotel, the Bo Li Building, the De Tian Tower, the Ming Da Building, the College of Law Twin Towers, the New Civil Engineering Building, the Shui Shen Pharmaceutical Building, and the Bi Zhen Building in North Hsin Chu.

8. Conclusion

NTU has already accomplished a great deal, now that its phase one targets, as outlined in its ATU proposal, have all been reached. The school hopes to extend its past accomplishments and to obtain even better results, so that the overall objective of turning NTU into one of the top universities in the world can be more quickly reached. With sufficient funding during the second phase of operations, NTU will place emphasis on the following endeavors, to reach its goal of becoming one of the world's top 50 universities:

- (1) To encourage its faculty and researchers to publish in the most prestigious journals in the world and to vastly increase the number of publications associated with the school, in order to raise the school's international profile and visibility.
- (2) To continue to push for interdisciplinary cooperation; and, through the impetus provided by research clusters, to become competitive globally either through attainments in certain areas of research, or through the achievements of its research teams, so that the strengths and advantages of NTU can be given full rein.
- (3) To continue injecting additional funds in order to develop key fields of research, and to actively discover and support promising research teams or topics.
- (4) To actively recruit talented and outstanding individuals whose publications have been widely cited, notable individuals in emerging fields, and Nobel Prize winners; to encourage these individuals to become resident scholars of NTU, so that they can undertake teaching and research at NTU for the benefit of faculties and students alike.
- (5) To actively nurture outstanding young scholars.

- (6) To work together with the National Science Council in promoting cooperative international science projects; to actively promote international cooperation projects, for instance the EU's FP7 program; to form strategic alliance with outstanding universities in North America and Europe, such as Cal Tech and MIT, or with exceptional multinational companies such as IBM.
- (7) To raise the competitiveness of NTU in terms of innovation and research and development; to strengthen the synergies that can be obtained by cooperation between the university and industry; and to cultivate an environment conducive to industry-university cooperation.

「邁向頂尖大學計畫」初審意見表之回應及改進

項目	審查意見
	<p>Basics, Policy Level Comments:</p> <p>1. Achievement is primarily measured by quality and number of academic papers published. Many world-class universities have established other benchmarks. NTU should incorporate some non-academic benchmarks of excellence.</p> <p>A: In terms of reference parameters, a more diverse evaluation of performance indices is being adopted worldwide and the method of ranking also changes to a certain extent. There is no single indicator that can apply to all universities. There are different indicators used for evaluation and ranking. Currently, the Shanghai Jiaotong World University Ranking, which puts more importance on academic performance, is more objective.</p> <p>On parameter indicators, NTU has for a long time now, stressed quality and quantity of faculty's academic research. On top of seeking higher numbers of published papers, we also track teachers' quality. For this reason, we closely watch qualitative changes, such as quantitative change for IF15% and IF40%, and qualitative changes in terms of Hi and H categories. Moreover, we emphasize our faculty members' garnering of international awards, invitation to speak in international conferences, students' participation in various international competitions, etc. They are indicators of excellence we also value at NTU.</p> <p>NTU will take into consideration above-mentioned performance indicators to assess the university's excellence or lack of it, and from there, pinpoint what may be generally accepted as indicators of excellence. That way, NTU can become more competitive in performance evaluation rankings.</p> <p>2. Lopsided emphases have been placed on hardware expansion. This poses serious problems for NTU to advance to world's 50, which demands extraordinary measures.</p> <p>A: The second phase will continue the dynamics we have accumulated in the first phase, to be combined with NTU's strong resources accumulated over the past as we work towards joining the World's Top 50. We plan to identify areas which are more internationally competitive and research centers that are close to reach international levels, while also putting efforts in the recruitment of outstanding foreign experts and training of young scholars on campus. Through our prognostic plan, we intend to identify newly emerging areas, and to seek partnerships with Academia Sinica, top international universities such as MIT, and renowned research facilities such as IBM and Intel, in carrying out collaborative research projects or in jointly establishing research centers. The achievement of balanced development in our 11 colleges will lead to total upgrading of teaching and research on the NTU campus. Moreover, it will lead to a flywheel effect that would help further contribute to NTU's Top Universities efforts. After four years of the first phase, we have attained goals on "world-class Chinese university." In the second phase, through joint efforts from the faculty and the student body, we will work towards making NTU an important name in international academic research.</p>

3. NTU lacks the desire to integrate outside resources or engage in strategic collaboration with other local universities. Too little has been invested in the humanities and social sciences. NTU should position itself as the Mecca of Sinology.

A: Sinology is a broad academic field and for this reason, countries develop their own areas of interest and specialties. To date, there is no single Sinological institute that covers everything. Decades ago, Taiwan used to make the claim that Taipei is the center of sinological studies. The Center for Sinology was thus set up within the National Library. It collaborates with the Chiang Ching-kuo Foundation in training and pooling together international sinology experts. However, its scope of academic studies is on literature, history and philosophy and its operational scope is quite limited.

NTU's College of Liberal Arts has its important position in world Sinological studies. Some ten years ago, it has, together with important universities in Japan, organized the Japan Sinology International Conference six times and has jointly held the East Asia Humanities Forum with five universities in South Korea and the PRC twice. With Mongolia, it has organized the Taiwan-Mongolia Forum three times in the past. The Institute for Advanced Studies in Humanities and Social Sciences has been developing academic exchange ties with Vietnam in the area of Confucianism. Similarly, various departments and institutes have close and substantive ties with universities in Europe and the US, such as Harvard, Columbia, UCLA, Heidelberg, London University, Univerzita Karlova, etc. There is frequent enough academic exchanges with international counterparts.

In the social sciences, the Institute for Advanced Studies in Humanities and Social Sciences currently implements five integrative research projects related to East Asian politics, psychology and legal studies.

4. Although NTU boasts the most support from domestic enterprises, compared with other universities in other countries, there is still room for alumni contribution. The current approach has been passive. NTU needs to aggressively seek outside resources and alumni contributions.

A: NTU has always worked towards enhancing interaction with alumni, including holding various activities and encouraging alumni participation, all with the goal of fomenting loyalty to their alma mater. Activities previously held in this regard include the following:

- (1) Alumni e-gazette: This allows NTU alumni to know the latest about the university and activities held by alumni groups. As of January 2010, 64 issues have been made available to 70,000 recipients by email on a monthly basis.
- (2) Alumni Bulletin Board: Updates on the university and alumni activities, as well as provides the latest employment information for alumni.
- (3) Facebook fan's club: NTU alumni are encouraged to use this forum to ask any question and they receive very timely response. Since it started in March 2010, 4,000 NTU alumni have been added. Through Internet social networking, NTU graduates can thus get in touch with fellow alumni spread around the world, share the latest news or answer questions posed online.
- (4) Publication of Alumni Bimonthly: Alumni have a choice between hardcopy and electronic version of this magazine. As of January 2011, this publication has completed 73 issues. Currently, more than 13,000 copies are sent out for every issue.

- (5) NTU Alumni English e-gazette: This informs alumni of the latest on academic research in the university. A total of 14 issues have been published and the number of subscribers has reached 34,904.
 - (6) Alumni are encouraged to apply for an alumni ID. As of Jan. 13, 2011, a total of 26,964 IDs have been processed, averaging a monthly 330. The ID card bearer enjoys on-campus benefits. In the future, business establishments will be tapped as collaborators, in the hope of increasing alumni willingness to apply.
 - (7) Assisting alumni to hold 30th Anniversary and 40th Anniversary Alumni Homecoming: Since 2007, four of these 30th anniversary alumni homecomings have already been held with assistance from the Alumni Office. The first 40th anniversary alumni homecoming will be held in 2011. These activities are well-supported by enthusiastic NTU alumni. Through the Alumni Status Information System, NTU graduates update their own information online, thereby assuring uninterrupted networking. Departments and institutes each assign a contact person who takes charge of updating contacts and providing employment information. Alumni are likewise encouraged to volunteer as batch contact persons, with the goal of assuring system information accuracy and timely updates.
 - (8) Alumni Campus Tour: During important university activities, a campus tour exclusive to alumni is held, giving them a better idea of NTU's past and present.
 - (9) Outstanding Alumni Selection: To acknowledge NTU alumni who have made important contributions to the school and to society, this selection was started in 2006. Some 39 recipients have been chosen over the last five years. Public announcement of choices are held during University Day. Contributions and achievements made by these outstanding graduates are reported through the school's various publications and through press releases. Some are invited to speak in the university's General Education Forum.
 - (10) University Day Gala Dinner: This event allows alumni association leaders from different places, outstanding alumni of the year and honorary doctorate recipients to get together in a lively yet relaxing dinner atmosphere. This is a way of giving recognition to their assistance to the university and of fomenting loyalty to their alma mater.
 - (11) Non-periodic holding of department homecomings and related activities.
 - (12) Future Plans: We plan to send e-cards during important holidays and on alumni's birthday. We have in our database about 100,000 email addresses. It is hope that these e-cards can make alumni feel always a part of the NTU family.
5. Your plan must avoid the practice of pirating teachers from local universities, which only contributes to M-shaped risk. Priority must be given to the hiring of prestigious professors in specific fields to come to Taiwan from abroad for teaching or research work. That is necessary to upgrade university standards and to better educate young students.
- A: NTU does not offer any special benefits as a way of pirating faculty members of local universities. However, in keeping with the spirit of the ROC Constitution, the employment of teachers must be fair and open and may not impose conditions and limitations (such as forbidding teachers from universities also applying for Top University grants) unless their specific fields do not meet requirements. Moreover, NTU gives priority to the recruitment of international academics with outstanding records.

Yet, limited by low salary levels and the lack of government policies on foreign faculty members' spouses, welfare, retirement reserve funds and taxation, as well as related measures, there has been little achievements in this regard. We still have to work towards this goal hand in hand.

6. Your plan requires a budget of NT\$4.5 billion per year, much higher than the first phase's NT\$3 billion annually. Of that, the figure for infrastructure improvement, amounting to NT\$1.3 billion (inclusive of library books and information, architectural space, dormitory, software and hardware improvement, etc.) is a very large one. A reallocation of resources must be done. Your funding structure relies heavily on government sources. Very little comes from the private sector. Therefore, a more ambitious goal must be set in this regard.

A: When NTU received the first-phase Top University grant in 2005, we have already convened the R&D Strategic Planning Meeting, in which we defined "campus infrastructure development" in terms of the following: (1) What are the research infrastructure and needs that a world class university should have? (2) Which infrastructure does NTU urgently need? (3) Discussion was carried out to evaluate the infrastructure assessment standards brought forward by each college. Issues on (3) above were fully deliberated on. In order to create a green, sustainable teaching and research environment needed by a Top University, to create a campus landscape more fitting of a top university, and to anticipate space needed for rapid growth in the future, we have come up with a list of infrastructure items considered to be urgently needed. The main consideration of course is on how they could enhance quality of teaching and research. NTU has an enrollment of 33,000, and a fulltime faculty of 2,000. For many years, owing to serious insufficiency of higher-education funding, major construction on campus was stunted, leading to a serious shortage of space. In the plan, the infrastructure items mentioned are those that we cannot do without. We believe that they are crucial to a continued upgrading of teaching and research quality, so necessary to help higher education in Taiwan to join the ranks of the world's top institutions of learning.

For a top university to have sustainable operations, generous government assistance in its crucial period is necessary, as well the need for institutions to design a mechanism for raising their own funds. NTU has done much in this regard, including: (1) The establishment, within the General Affairs Department, of an Operations Management Section, which takes charge of planning and developing relevant operations management duties, (2) Using BOT, loans and fund-raising mechanisms, we have tried to activate greater utilization of university properties, (3) Promoting the construction funds sharing system: Since the establishment of the university affairs fund in school year 1996, the ratio of funding raised on their own by colleges and departments has grown from 20% to 66.85% in 2006 and 72.54% in 2010. In the future, we will emulate practices of top universities abroad in establishing a system for raising funds through alumni contribution.

7. NTU received an annual grant of NT\$3 billion in the first phase of the Top University Development Program. Yet, recently when study grants for graduate students were slashed, the school cited as reason budget insufficiency, drawing protests from students. As NTU is the top university in Taiwan and owing to its social clout, it must avoid projecting a negative image in society.

A: Since start of the Top University Development Program in 2006, NTU has allotted about 600 teaching assistants, whose salaries are derived from the Top University Development Program expenses. The

graduate student study grant is sourced from budgets under the university affairs fund. The said fund is used, in addition to assisting graduate students to finish their degrees, mainly for shouldering work related to teaching in various departments and graduate schools. In 2010, the budget was NT\$3.6 billion. The employment of TAs has increased graduate students' economic sources.

Between 2006 and 2009, TAs received salaries as follows: PhD student TAs received NT\$10,000 monthly, MA student TAs received NT\$6,000 and university student TAs between NT\$3000-5,000. In 2010, because what the PhD students were getting was higher than the hourly lecture fees for part-time teachers, and because of its large gap with that of MA student TA salaries, the TA salary for PhD students was lowered down to NT\$8,000, while those of MA level students was adjusted to NT\$4,500-6,000 per month based on experience and work load. University student TAs' salaries remained the same. These adjustments were made necessary by a 25% drop in budget in Top University Development Program grants in 2010 from the 2009 level. Besides, funds for 2011 will only be released in April. In view of the above, it can be seen that the adjustment of TA salary standards is reasonable.

Internationalization

1. Although NTU has in recent years worked towards internationalization, the fruits are not significant.
A: Internationalization represents one of the major emphases of NTU in terms of the Top University Development Program. Over the last five years, our achievements have been well confirmed in Taiwan. In 2010, NTU has the following achievements in its efforts to internationalize: In 2010 alone, the number of our faculty members joining international exchanges reached 6,600, and we signed sisterhood ties with 366 institutes in 51 countries. They include 29 dual degree programs, 235 student exchange plans, 18 professorial exchange programs, four summer courses, and joined 9 organizations for higher learning. We vied to organize important international conferences. All these achievements are far ahead of any other university in Taiwan. In terms of international students, in 2010, there were 1,813 foreign students from 68 countries who came to study in NTU. Of them 618 were international exchange students. Programs using English as medium of instruction has reached 14 in all. We have also held summer courses for students from all over the world to study Chinese or take related research courses. The university has likewise exerted efforts in the internationalization of local students by developing various overseas education plans. In 2010, NTU endorsed 445 of its students to go abroad for student exchanges and visits. Some 189 students took summer courses in Stanford University, UC Berkeley, Oxford University and other schools. The numbers tell about the development of internationalization at NTU and they are leading development in all other schools in Taiwan. In fact, the records are also impressive compared with other universities in Asia. Owing perhaps to the great diversity of internationalization efforts, many of these are unreported. We find no reason to say that NTU has insignificant fruits in terms of its internationalization efforts.
2. There is much room for improvement in terms of foreign students coming to NTU for degree-granting courses.
A: In terms of foreign students, our response will be fused with that of Point 5.

3. The school's dual degree (joint degree) programs began earlier and have to be expanded even more.
- A: NTU currently has 29 dual degree (joint degree) arrangements with 22 universities. As this mode involves both schools' credit recognition, tuition fees payment, joint advisorship, etc., the signing of each agreement takes much close consultation between both sides if real opportunities are to be created. In the future, NTU will assist colleges and departments in the signing of appropriate dual degree (joint degree) collaboration plans and will further encourage students to participate in these programs and school exchanges. Recently, there has been a rise in the number of consultations and we predict rapid growth in this regard.
4. There is little willingness among students to travel abroad. It is suggested that proper measures be taken to encourage NTU students to go abroad for studies. Sending outstanding teachers and students abroad is an important internationalization strategy and for this, NTU must adopt measures to improve teachers' and students' English competency.
- A: In 2004, NTU adopted the *Implementation Measures for Dual Degree Arrangements with Foreign Universities* to help local students complete their degrees overseas. Moreover, the school has also increased the number of foreign exchange students coming for short-term studies. The goal for the next five years is to have at least a third of university-level students to spend at least a semester (or summer) abroad for exchange studies.

On your suggestions regarding improvement of English competency, we have the following response:

- (1) For students, NTU currently has various measures, such as (i) Requiring bachelor's-level students to reach a certain level of proficiency and to take the Advance English Course, (ii) The Audio-visual Center has been entrusted to establish online English learning self-help classes and provide an efficient learning mode, (iii) Offering "graduate level online English courses," (iv) Establishing a Writing Center to help students improve their English-writing capabilities. In the future, NTU will seek to further improve these measures.
 - (2) On faculty members, NTU will consider applicants' English proficiency in hiring new teachers.
5. In the process of accepting foreign students and in recruiting foreign teachers, attention must be paid in getting really excellent ones. Formalities and statistics must not be the basis of consideration. It is suggested that NTU provide information on foreign students' country distribution.
- A: On foreign students, we combine our responses to Points (2) and (5) above as follows:

The number of foreign students (foreign nationals and overseas Chinese) at NTU grew from 1,417 (342 foreigners and 1,132 overseas Chinese) in 2005 to 1,812 (640 foreign nationals and 1,172 overseas Chinese) in 2010, representing a growth of 27.9%. The number of foreign degree students at NTU is the largest in Taiwan and it is still growing at a rapid rate. Although the recruitment of foreign students involves curriculum design, language requirements, teaching and guidance, administrative resources and other such measures, we at NTU are aware that the quality of foreign degree students is far more important than quantity. Most foreign students (excluding the overseas Chinese) recruited by NTU come to take graduate school. After two years of tracking students ratings, we found out that about 60% of foreign graduate students rank among the top 50% of their classes, suggesting that these

foreign students' performance is not worse than locals. In the future, the university, while insisting on teaching quality, will continue recruiting excellent foreign students. In terms of quantity, we target a stable growth and will avoid precipitation.

On foreign students' countries of origin distribution, NTU has already set a ratio of 3:3:2:2 for Northern Asia, Southern Asia, Europe and USA, and Other Areas respectively. Of these, foreign students from Europe and the USA in recent years have made up about 20% of the total, and the figure is increasing in a stable manner. These figures show that NTU is attractive not only to Southeast Asian students but to Europeans and Americans as well. In terms of country of origin, the largest groups come from Malaysia, the US, Japan, South Korea and Indonesia. Foreign students at NTU come from approximately 70 countries. The following table illustrates student distribution according to region. If a country-wise distribution is necessary, NTU would be glad to provide relevant statistics as well.

Region	Total (Foreign Nationals and Overseas Chinese)	Number of Foreign Nationals	Number of Overseas Chinese
Asia	1,427	393	1,034
Europe	90	85	5
Africa	25	15	10
The Americas	262	140	122
Oceania	9	7	2
Total	1,813	640	1,173

6. More programs using English as medium of instruction can be offered so as to help Taiwan meet future needs.
 - A: In keeping with trends towards internationalization, NTU has greatly increased the number of such programs. Moreover, to encourage departments into offering programs using English as medium of instruction, and to attract more foreign students to come and take graduate studies, NTU established the *Methods for Granting Incentives to Total English Academic Programs* on Nov. 23, 2010.
7. Exchanges and collaboration with overseas universities and academic research institutions must emphasize substance and must avoid an endless expansion of figures and statistics, which only lead to thinning of resources.
 - A: NTU enjoys sisterhood ties with 370 institutions spread across 50 countries. Not only have we developed relationships of amity but likewise always seek for a win-win situation in real, substantive terms. Currently, we have student exchange plans with 236 universities, involving dual (joint) degree arrangements with 22 universities and leading to 29 degrees. We have 10 student mutual visit arrangement and have signed summer programs with four universities. The scope is large and still growing. Each year, some 1,000 of NTU's student body benefit from these exchanges which greatly contribute to making them develop international vision. For teachers, in addition to professorial exchange arrangements, we have numerous, very active international collaborative teaching and research efforts, some of them arranged on teachers' own initiatives. Furthermore, there is much initiative taken in the holding of academic conferences, presentation of academic papers and carrying out exchange visits.

NTU also has signed collaborative agreements aimed at assisting the country's diplomatic endeavors, but their number is small. Today, our emphasis is on seeking collaborative partners that match NTU's development orientation and who have excellent academic reputation. On the level of universities, we adopt a strategic thinking based on realm, and have pinpointed top universities as target of forging sisterhood ties, such as MIT, UIUC, Oxford, UC Berkeley, etc. On the college level, each college makes its own choices based on academic development needs. Care is always exercised in selection. The above measures we adopt are a way of focusing resources so as to generate the maximum benefit.

8. SCI papers are presented in a static manner. Further consideration can be made regarding the holding of international conferences and in being proactive in increasing the international visibility and clout of your school.
- A: NTU has always stressed teachers' and researchers' dynamism in international academia. In the first stages, the establishment of the *NTU Top University Development Program Pointers for Grants on International Exchanges*, the *Pointers for Stipends for New Teachers Joining International Exchanges*, and other such methods paved the way for sufficient funding when it came to international exchanges. These methods allow each college to plan and orient their international exchanges efforts towards their own development needs, especially in encouraging talented new teachers to participate in short-term seminars, international collaborative research, etc. Since their implementation, these methods have led to excellent results, notably in assisting teachers to participate in international collaborative research. According to statistics, some 5,894 international exchanges were completed in 2009, and the number of on-campus international conferences held reached 164. All these reflect how NTU's faculty and researchers have achieved much in international academic affairs.

In the future, efforts will likewise be directed towards increasing the international visibility and prominence of teachers, both old and new, and researchers as well. We will take good advantage of sisterhood ties to encourage teachers into engaging in international collaborative research, involvement in international academic affairs and in seeking top roles in major international conferences (such as serving as program committee chair, general chair, steering committee member, keynote speaker, etc.) and in taking core responsibilities in international academic organizations such as serving as the President Awards Committee chair, editor-in-chief, vice-president for publications, fellow selection committee, etc.

Industry-Academia Collaboration

1. There is much room for improvement in intellectual property-derived income. There must be more output of crucial intellectual properties, and patent right royalties as well. More financial incentives can be offered to encourage inventors and their associates.
- A: While professors engage in basic research and if their achievements can find application in industry and in bettering social welfare, the university always encourages patent application, technology transfer and licensing. All these for the sake of giving a commercial value to research achievements while also generating intellectual property-derived incomes for the school. Although many basic research results

are not immediately commercialized, they still have strong potentials to become crucial intellectual property required by some industries. NTU generated intellectual property incomes in 2009 and 2010 amounting to NT\$68,552 and NT\$135,120,157 respectively. The incomes from licensing in 2010 should be the top among Taiwan universities. As a way to encourage inventors, NTU grants research and technology transfer incentives to inventor groups amounting to 20-70%, after deducting taxes and dues and based on patent fee-sharing schemes previously selected by investors.

2. Your school must set ambitious targets in seeking private-sector collaborative funding.

A: In 2008, 2009 and 2010, NTU accumulated industry-academia collaborative funding with private-sector enterprises amounting to NT\$282,135,000, NT\$355,466,000 and NT\$422,405,000 respectively. They take up respectively 4.12%, 4.96% and 6.76% of all research funding obtained from the government, financial entities and private-sector businesses combined. NTU's professors mostly engage in basic research. In contrast, most enterprises seek technologies nearing commercialization and mass production. Only those interested in near-basic research R&D do approach NTU professors to conduct industry-academia collaboration. As NTU is a research-type university, the mode of collaboration is more concentrated. Nonetheless, the university still promotes such collaboration and in the process, seeks funding from industries. Most importantly, we hope to improve competitiveness of industries and contribute to welfare in society.

3. The idea of how industry and academia can interact such that common problems can be identified is worth further thought and consideration.

A: This school year, NTU's Industry-University Cooperation center began contacts with the Chinese National Federation of Industries and various industry associations and federations to seek complementary collaboration and to better understand industry needs. The idea is to identify common problems and issues necessary for further industry-academic collaboration, their modes and technologies.

4. NTU has a large College of Engineering and College of Medicine but patent innovation remain insufficient. Efforts must be put in this regard.

A: Many NTU professors engage in basic research. If their achievements can find industrial application, there are greater potentials and opportunities for licensing. For this reason, NTU encourages them to apply for patents. Most researches done in NTU are innovative but a large percentage of them are not ready for immediate commercialization. In contrast, many enterprises seek almost-ready technologies nearing commercialization and mass production. Moreover, owing to existing legislation, most innovative technologies cannot find licensee targets. Patent application instead becomes a financial burden for the school. However, this problem has gradually been relieved as Taiwan's industrial circles have put more emphasis on basic patents. In the last three years, the number of patent applications has increased tremendously and incomes from licensing have also risen to a great extent.

5. Killer patents are few and far between.

A: Response as in Point (4) above.

Teaching and Research

1. The TA Project must be further strengthened.

A: Since the TA project was launched in 2006, NTU has already devised a comprehensive method governing TA selection, training, consultation, evaluation, certification and incentives. In the future, following suggestions, NTU will streamline and improve the pragmatics in such a way that can better assist teachers in improving quality of teaching.

2. A better method for general-education planning and implementation is necessary.

A: NTU's general education program is quantitatively stable. The school closely monitors the number of courses offered and moreover, fortifies existing program structures and plans. In addition to offering new courses as needed, we also cut down on those we find unnecessary. In future course planning, we will at the same time consider teachers and resources and analyze each field's faculty requirements, as well as courses' appropriateness when included in the academic programs of departments and institutes. The university will also devise strategies that will encourage teachers' willingness to offer general education courses. For instance, department heads may be invited to first offer courses or by those who have national chair status and teachers who have received awards. This will create an impression that NTU emphasizes general education. Currently, curriculum planning is done by conveners representing eight major areas, together with a working committee. They carry out initial analysis and planning, after which they make a proposal to the General Education Group and the curriculum committee of the Joint Education Center for proper collation of information and statistics. The latter serve as bases for planning and enables identification of courses requiring improvement and adoption of strategies. On top of current mechanisms, we will adopt opinions from teachers and students, especially giving opportunities for various departments' faculty and students to voice their views and ideas. The latter is expected to smooth communication and foment a healthy exchange of educational ideals. Furthermore, general education will not be limited to offering of courses, but has to involve promotion by the whole university community. Interdepartmental cooperative relationships are crucial to the smooth promotion of general education on campus and its inclusion in NTU's campus culture. Having said this, interdepartmental cooperation will thus be a future direction of our task in this regard.

3. The soundness of establishing a regional education resource center remains to be seen.

A: The Second Northern Zone was established about 10 months ago but it has already pushed for integration and sharing of teaching resources in the zone, such as the Summer Institute, new teachers' seminar, library information and services, teachers' growth communities, etc. Much has been achieved, and the following are just a few examples:

- (1) Summer Institute: It offers 16 courses and has so far benefitted more than 900 teachers. Average satisfaction is 4.44. Training of TAs in the zone was conducted, which also led to the selection of outstanding TAs.
- (2) New Teachers' Seminar: A two-days-one-night seminar was held in Dabangen. This activity garnered 4.75 for participants' satisfaction. Teachers were greatly encouraged and went back to their schools armed with enthusiasm.

- (3) Library Information and Services: NTU provided temporary library borrowing services and added a library resources inquiry zone for teachers and students in the Second Northern Zone.
- (4) Teachers' Growth Community: More than 300 participants formed 36 groups aimed at promoting mutual learning among teachers in the zone, improving teaching quality and encouraging self-growth.

Overall, the Second Northern Zone Center is a success. We hope that through NTU's resources and personnel, we can enhance teaching quality in the zone, help train better teachers and hone their competitiveness.

4. More TAs can be hired for even-better teaching quality.

A: Within the scope of our budget, we will do as suggested.

5. The university must avoid too much emphasis on research at the expense of improving quality of teaching.

A: NTU is aware that teaching and research are the most important functions of any university. To avoid teachers' lopsided emphasis on research at the expense of teaching quality, we have adopted some countermeasure policies. For instance: we implement the *Method for Excellent Teachers Selection and Reward*. Any teacher who has been selected twice is exempted from teachers' evaluation. We allot TAs and have established the Teaching Development Center for teachers' consultation and assistance in terms of pedagogical techniques, etc.

6. More fulltime researchers can be hired to exercise resource leverage. This also benefits the university's efforts to improve academic standing globally. Liberal education and the Light of the Research Institute both must be strengthened. Universities must emphasize both teaching and research, and research-type universities are no exception.

A: To expand our channels for recruiting researchers, NTU has revised the *Implementation Measures on the Employment of Teachers and Researchers Using the University Affairs Fund*. One who has been involved for more than two years in industry-academia collaborative research projects and who has shown strong academic research performance are recruited as researchers following NTU's evaluation procedures. Only in this way can the school train people in basic research necessary for R&D excellence.

Although NTU is labeled as a research-oriented university, we put equal emphasis on teaching and research. Currently, the school's efforts in curriculum reform are oriented towards making students gain breadth and depth, emphasizing both humanistic training and professional capabilities. Only so can we create an environment for shaping the total person. For this reason, we have for so many years now not only emphasized general education and its continued improvement both in terms of quality and quantity, we have also been continuing to review and improve professional courses. NTU will take heed of your advice as we constantly seek for perfection and enhancement of quality of teaching.

7. Emphasizing that NTU is a top-caliber university based on the number of academic papers is lame. Instead, NTU must have some areas that other countries must emulate. In other words, we want to see people from all over the world coming to learn from NTU.

A: Among ESI's 22 areas, NTU ranks among the top 1% in 16 in terms of the number of citations. NTU will in the future consider national development needs in pinpointing internationally competitive areas, and help relevant NTU units in attaining prestige. Only then can we attract people from around the world to NTU.

Personnel Training

1. There must be more concrete ways of training internationalized research personnel.

A: The Academic Affairs Department's Career Development Center takes charge of employment opportunities for students and study guidance. To better encourage NTU students into studying abroad, the center provides a number of services tailored to the needs of NTU students, as follows:

(1) Overseas Studies Activities:

Every year, the center jointly holds Overseas Studies Activities with the NTU Graduates Association. Returning students from overseas studies are invited to give a talk, share their experiences in seeking employment and selection of target study country, as well as school and course selection issues, how to prepare and what to expect. This activity is an important way of preparing students in the lower batches to excel in their overseas studies.

(2) Overseas Studies Consultation:

(a) Establishment of online appointment for consultation services: Professors with overseas studies experience serve as consultants for prospective students seeking information on overseas studies application, including: sharing of experiences, selection of schools, writing of study plans and autobiography, request for recommendation letters, techniques in school application, etc. This practical consultation channel is a supplement to Overseas Studies Activities.

(b) Cooperation with AIEF: To better provide information and assistance on studies in the US, NTU has jointly held small consultation sessions with AIEF. AIEF, the official consultant center of the State Department's Bureau of Educational and Cultural Affairs, provides comprehensive, neutral and accurate information. The Overseas Studies Consulting Center provides the same information to students or their parents, including school selection, scholarship opportunities, application procedures, student visas and pre-departure preparations.

(3) Providing overseas studies-related information: This includes announcement of student recruitment news from international universities and providing assistance on the holding of related briefings. Every year, at the end of summer vacation, NTU holds an Overseas Studies Experience-Sharing Seminar together with lectures on international etiquette. Furthermore, we also publish handbooks that include useful information on study destination countries, interviews with students on their study experience, etc. Moreover, NTU makes use of the "service learning" course, an undergraduate requisite, to encourage student associations or dormitory residents' groups to form international volunteer service groups or to hold service learning exchanges with foreign students on campus.

2. Internationalization will be the development trend of Taiwanese industries (manufacturing, services) in the future. The school must offer courses in each department that introduce the idea to students. These courses must be tailor-made to the departments' needs.

A: NTU will make the same suggestions to all departments.

3. Students in the college and graduate school levels must have social exposure or learn industry interaction. Learning must not just be theoretical but instead help students realize their future development potentials.

A: NTU currently offers the Leadership Program and the Creativity & Entrepreneurship Program to help students interact to a certain degree with society and industries. Service-oriented student groups and the school's service learning course also help in this regard. In the future, departments and institutes will be reminded to take this point into consideration when they design their curriculum.

4. NTU has to take the lead in providing assistance to indigent students, thereby becoming influential when it comes to higher education reform in Taiwan.

A: NTU uses various means and occasions to educate people on relevant laws, national education policies on social welfare and the handicapped's right to education. The school also conducts learning and sharing events with handicapped students who show outstanding performance. We have also taken the initiative of informing departments and institutes on NTU's services for handicapped students, guidance counseling, installation of resources and classrooms, etc. as a way to encourage departments into accepting physically-challenged students at a ratio of 1 to 100. In line with Ministry of Education policies, we have also encouraged departments to admit more aborigine students and increase student quotas for the Multi-Stars Project.

As a way to assist indigent students, NTU offers various financial assistance schemes and has adopted all types of daily-living guidance measures, as follows:

- (1) Economic assistance: This includes streamlining on-campus information channels and application procedures with the goal of assisting students in making good use of available scholarship and assistance funds (public- and private-sourced), Hope study grants, state scholarship and tuition wavers, study loans, emergency financial relief and assistance, etc. NTU has also established a "Stable Studies" system that assists students to smoothly complete their studies.
- (2) Various counseling measures: (i) Establishment of an individual-management mechanism, (ii) Lone-Star interview, (iii) Guidance for the handicapped, (iv) Charity lunchbox for students from low-income families or needy students. These half-price lunchboxes are provided Mondays thru Fridays, lunchtime. In 2009, 42 students received assistance through this measure.

綜合審查意見及計畫書修正建議(2010 邁向頂尖大學計畫)

1. Suggest establishing closer collaborations with the Academia Sinica to combine the best research and academic units of Taiwan and create a win-win situation.

A: The Academia Sinica is the top academic research institute of Taiwan while National Taiwan University is the most outstanding university; the two institutes have long histories in joint recruits of talents, sharing research sites, and collaborations in the international graduate student program; all with fruitful results. NTU has conducted meetings with the Academia Sinica to discuss cooperation in 2006, with a hope that under long-term cooperation, both units could head toward the world's top research and teaching institute. It is also expected that strengths can be further established to create emerging fields and strive for world's leading status. President Wong Chi-Juey of the Academia Sinica also responded that the meeting can help them examine the past and explore the future to create a win-win situation.

NTU has collaborated with the Academia Sinica in the following two programs:

(1) Genome and Systems Biology Degree Program

The program integrates faculties from genosome and system biology related fields, including College of Life Science, College of Engineering, College of Bio-Resources and Agriculture, College of Science, College of Electrical Engineering and Computer Science, College of Medicine, Center for Systems Biology, and the Academia Sinica. With the approval from the Ministry of Education, the program was established in 2010 and started enrollment in the 2010 academic year. The 21st century is the century of bio-science, and with bio-technology industry listed as the focus for national development, it is one of the stars in the "Two Trillion & Twin Star" project of the Executive Yuan. Since systems biology is an emerging cross-departmental field, talents should be cultivated systematically with plans. Talents cultivated from this program can greatly develop their expertise in the academics and the industry, creating an impact in relevant fields for the society and the nation.

(2) PhD Degree Program in Translational Medicine, jointly organized by NTU College of Medicine and Academia Sinica

The PhD Program in Translational Medicine is jointly established by NTU and the Academia Sinica, with the first enrollment in the 2010 academic year. The aim of the program is to develop bio-medicine research with translational medicine as the core, train excellent scientists and doctors in the translational medicine field, strengthen translational medicine research and clinical medicine quality, and assist industries to enhance their competitiveness in the world's bio-medicine field. The program covers extensive medicinal related fields to promote basic and clinical research collaborations. The program is open to all, so that students from different backgrounds could stimulate more ideas through exchanges and communication. The program is an important milestone in academic research for both the College of Medicine and the Academic Sinica. Through joint supervision, more substantial and interactive academic research collaboration can be established, which can greatly enhance the academic standing of Taiwan medicine in the international arena.

2. Balanced development and key breakthrough is contradictory. It seems more reasonable to refer the former as the base and the latter as reaching the top.

A: For NTU to rank among the world's elite, not only should its average research performance attain a certain level, making outstanding achievements are especially important. In order to encourage

outstanding research, it is vital to place equal balance on fundamental development and aiming for the top. “Key breakthrough” is finding research teams with potential to become world-class and providing them with necessary supports. “Balanced development” is elevating research levels of all domains. This is the concept of “balanced development, key breakthrough”. While respecting the principle of the autonomy of scholarship in each field, the university combines the strengths of each college and institute and all of the university’s resources in order to realize the university’s potential and develop local resources while going global, all with the ultimate goal of stepping into the ranks of the world’s elite universities.

3. Has the target “doubling the quality and quantity of research papers” being achieved? Would “after 5 years of effort, the total number of research papers and HiCi papers have nearly doubled, with 16 fields entering HiCi” be supportive for reaching the target?

A: Quantitatively, since the implementation of the ATU project, the total number of papers published in SCI listed journals increased from 3,378 in 2005 to 4,783 in 2010, showing a growth of 41.6%; the number of papers published in SSCI listed journals increased from 150 in 2005 to 410 in 2010, a growth of 173.3%; the number of papers published in A&HCI listed journals increased from 8 in 2005 to 31 in 2010, a growth of 287.5%; the number of papers published in TTSCI listed journals increased from 120 in 2005 to 231 in 2009, a growth of 92.5%. Significant growth is seen in all academic research areas, especially teachers in the humanities and social sciences, where the number of papers published in SSCI and A&HCI has dramatically increased. As for the rankings in five areas of expertise in *The Times* Higher Education–QS World University Rankings 2009, improvements have been made in the area of arts & humanities from 152nd in 2008 to 60th-place rank in 2009 and social sciences from 74th in 2008 to 58th-place rank in 2009. These improvements have prompted NTU to break into the top 100 world universities with an overall ranking of 95. Qualitatively, the number of highly-cited (HiCi) papers grew 98.3% from 117 in 2005 to 232 in 2009. From 15% and 40% of high impact factor of SCI, SSCI, A&HCI journals during 2004 and 2010, papers published in top 15% by NTU faculty increased from 37.3% in 2005 to 40.0% in 2010; top 40% paper publication increased from 67.6% in 2005 to 69.1% in 2009. The average IF value of the number of papers published in top 40% in the past 6 years has reached 69.6% of the total publication. These growths are indicative that the academic research performance of NTU is close to the doubled quality and quantity objective of phase one.

4. The principal objective of the first phase is to reach world-class status in 10 to 15 academic fields within five years, how do you define world-class, and has this objective being achieved?

A: A top university must be strong in each and every field. Among 22 areas of specialization in the ESI database, 13 fields of NTU were included in the ESI ranking (or top 1% in the world) in 2005. These 13 fields are evenly distributed in the 6 categories: Engineering, Life Science, Social Science, Science, Agriculture, and Medicine. By 2007, this number has increased to 15 fields (two additional fields are Microbiology and Molecular Biology & Genetics). Also, the global rankings of 12 of these 15 fields based on total number of papers have improved. As of 2007, 4 fields were in the world’s top 50 (Computer science, Engineering, Chemistry, Pharmacology & Toxicology), and 5 were in the world’s top 50-100; in 2008, 5 were in the world’s top 50 (Computer science, Engineering, Material science, Chemistry, Pharmacology & Toxicology), and 4 were in the world’s top 50-100. In 2009, 16 fields were included in the ESI ranking, with a total of 232 papers. Geosciences also entered the top 100, with

a ranking of 94. In 2009, 5 fields entered the world's top 50, and 5 fields in world's top 50-100. In 2010, NTU ranked 60th in the ESI ranking as the only university in Taiwan to enter top 100. (Please see page 6 in the ATU project proposal)

5. The University of Illinois at Urbana Champaign (UIUC) has been selected as a benchmark, and aiming for top 50 as the current objective, how feasible would this be? Unless an unprecedented method has been implemented, this seems mission impossible.

A: We hold the same view with the committee member. The Higher Education in Taiwan is facing severe global competition, and unless an unprecedented method is implemented to change the current status, we would lose our edge and face marginalization. Take China for an example, specific schools such as Shanghai Jiaotong University and Beijing Tsinghua University have implemented a different system called "special education zone" in order to enhance higher education quality. Large amounts of money have been provided to recruit world talents. No evaluation mechanisms were necessary during the recruitment process; research teams also have no pressure for paper publication, which gives research teams flexibilities to develop their potential. Such innovative and breakthrough method resulted in unimaginable explosive force. In contrast, as a national university, NTU is restricted by government regulations. We expect relaxed measures in accounting and personnel in order to attract world talents and promote international competitiveness.

Despite restricted policies, NTU is ahead of UIUC in 4 areas (Material Science, Chemistry, Clinical Medicine, and Pharmacology & Toxicology) among 22 areas of specialization in the ESI database with outstanding performances. In terms of publication quality, NTU only has 232 highly-cited papers (UIUC 728) and 6 highly-cited authors (35 in UIUC). This shows areas for improvement in paper quality. The capacity accumulated from the first phase of the ATU project will be extended, with doubling the number of publication in top quality journal as short-term goal. Fields with international competitiveness or top-rated research centers will be selected, and outstanding scholars from abroad will be invited to cultivate outstanding young scholars within the campus. In the mean time, emerging fields can be found from forward-looking projects, and research projects or research centers can be established with the Academia Sinica, renowned top universities around the world (such as MIT), or top research institutes (such as IBM and Intel). Balanced development of the 11 colleges in NTU would create multiple positive and synergic effects to enhance teaching and research as we speed our way to world's top 50.

6. Please encourage enterprise fund-raising to treat NTU education as a major deliverable.

A: Professionals from enterprises participating in teaching and curriculum design satisfy the objective of integrating practice and theory. Students can work as interns in enterprises during the summer, and continue working after graduation.

(1) Trend Micro Taiwan Chairman Steve Chang, CEO Eva Chen, Chief Culture Officer Jenny Chen, and Trend Micro Taiwan donated to set up Cloud Computing Trend Program to promote education on cloud computing knowledge, enhance academic standard, and benefit the society and the country.

(2) Polaris Securities Co., Ltd. donated to set up Quantitative Financial Analyst Program to promote the education of quantitative finance, enhance academic standard, and benefit the society and the country.

- (3) Macronix International Co., Ltd. donated to set up “Macronix Seminar”, inviting well-known scholars with outstanding achievements in international academic research to promote teaching and research standard, with an aim to cultivate more talents.
- (4) On the basis of their love for Taiwan, E.Sun Commercial Bank, Ltd. and E.Sun Cultural and Educational Foundation donated the College of Management in NTU to set up “E.Sun Scholarship” to help NTU enhance academic standard in management and reward top journal publication, in addition to benefit the society and the country.
7. Some quantitative indicators listed in Figure 2 of the abstract awaits inspection check. Long-term visiting scholars, full-time foreign teachers and students should also be included in the quantitative indicator for inspection.
- A: (1) NTU has actively invited long-term foreign visiting scholars and full-time outstanding foreign teachers. As of the 2010 academic year, there were 126 long-term foreign visiting scholars and 141 full-time foreign scholars. Recruiting worldwide elites and scholars to NTU is one of our expectations, but due to low salary, and the exclusion of remuneration, fringe benefits, pension plan, and a proper tax system, NTU was not able to recruit on long-term basis, which is one of the difficulties at the present.
- (2) The enrollment of international students is one of the important indicators of internationalization. The number of increase from 2005 to 2009 is as follows: 17% increase in degree students (including overseas students, or 72% excluding overseas students) and 250% increases in exchange students, the total number is 2291, which is 6.9% of the total enrollment. The growth of international students is 1.15% for exchange students and 0.5% for degree students (0.7% excluding overseas students). These are 0.2% higher than the national average, regardless of growth rate, percentage, growth percentage. In terms of recruitment, NTU values more on ‘quality’ than ‘quantity’, so excessive enrollment is not permitted. With excellent international student enrollment, campus internationalization can be fully fulfilled.
8. There are around 3,300 full-time staffs, but only 11 researchers and 20 rare technicians; are there any benchmarks? As a top university, there should also be a considerable amount of researchers.
- A: Full-time teachers are obliged with teaching and research duties. In order to expand channel for inviting excellent researchers, we have revised the regulations in ‘Regulations for teaching and research staff recruitment using university fund’, post-doc researchers with at least two years of experience in cooperative research program with academic research performances can be recruited as a researcher after internal examination. Post-doc talents are indispensable; therefore, the ‘ATU project-Subsidy for post-doc researcher and research technician regulation’ is instituted to actively recruit post-doc researchers. 300 posts in post-doc and 50 technicians were provided to leverage insufficient funds in external research. However, due to a lack of competitiveness in the pay for Ph.D. researcher, the issue of human resources awaits policy change.
9. The second phase of the five-year plan states that NTU wants to be world’s top 50 and the pinnacle of the Chinese world; the former is very difficult to achieve while the latter has already been achieved.
- A: With the funding from the ATU project, NTU’s ranking ascended from the 183rd-place in 2005 to the 127th-place in 2010 after five years of efforts, surpassing National University of Singapore for the first

time, achieving the impossible mission of ‘the pinnacle of the Chinese world’ on the Academic Ranking of World Universities (ARWU) announced by Shanghai Jiaotong University. The second phase of the project will accumulate the capacity from the first phase. In addition to abundant assets from the past, the second phase ATU center, and the Office of International Affairs, worldwide first-class talents will be recruited to produce synergy effects and speed up the development of NTU as a renowned bastion of education and research, competing with other top universities in the international arena, and fulfilling the social responsibility for sustainable development.

10. With regards to the progress made in National Chair Award, Academic Award, and Outstanding Research Award, this is the ultimate result from concentration of elites, yet under such circumstances, what would be considered as reasonable performance?

A: (1) NTU is a comprehensive full-fledged research university; NTU currently has 11 colleges and 2 schools: School of Dentistry and School of Veterinary Medicine. The number of university students at NTU is roughly the sum of university students at National Cheng Kung University (NCKU) and National Chiao Tung University (NCTU) combined.

(2) NTU, NCKU, NCTU, and NTHU award ratio among 11 research universities within ten years (2001 to 2010) is as follows:

	NTU	NCKU	NCTU	NTHU
MOE National Chair Award	43%	6%	6%	26%
MOE Academic Award	45%	7%	10%	23%
NSC Outstanding Research Award	39%	14%	10%	14%

NTU is a comprehensive university with balanced development in all fields. It has outstanding teams and performances in every area, gives consideration to all academic thoughts, and is a melting pot for culture and technology. NTU is far ahead of any other domestic university by any academic achievement indicator. The total of the aforementioned awardees is higher than that of the three other domestic universities combined. Despite all these significant achievements, NTU has only received 30% of annual subsidies among 11 research universities from the ATU project between 2006 and 2010.

11. From the progress made in paper publication and international visibility, it is weak to say that 10 to 15 fields have become world-class.

A: Despite 16 fields of ESI publication have reached world-class level, and the integration from within has doubled the figure, more efforts are required in order to compete globally. From the first phase of the ATU project, the number of paper publication has significantly increased. The number of HiCi papers has also doubled. Therefore, in the second phase, advantageous research fields from ten research centers or respective colleges will be selected for substantial exchanges and cooperation with top 20 universities listed on the Academic Ranking of World Universities (ARWU) announced by Shanghai Jiaotong University, such as MIT. In addition, R&D centers are planned to be jointly established with the Academic Sinica and focus research teams of well-known research institutes such as IBM or Intel.

By establishing international top university research center on campus, participating in cross-country research cooperation, introducing international talents for emerging field research, the international visibility of NTU can be greatly enhanced.

12. International students should be of quality, and should set up indicators.

A: Same as the response from number 5.

13. The achievements of industry-university cooperation is usually the achievement under government support. NTU should also provide funding from private sectors and set high standards. (Page 29 of the proposal states that government sectors including NSC, Council of Agriculture, and so on provide around NT\$5.2 billion dollars while NT\$450 million dollars came from corporations, public and private enterprises, of which are mostly government sectors)

A: Industry-university cooperation with private sectors in 2008, 2009, and 2010 were NT\$282,135,000, NT\$355,466,000, and NT\$422,405,000. Research funds from governmental agencies, corporations, and private sectors were 4.12%, 4.96%, and 6.76%. Most professors of NTU conduct fundamental research, and most companies look for technologies close to their products and mass production. Companies interested in the front-end of the basic R&D would cooperate with our professor for industry-university cooperation. From the influence of research university, industry-cooperation partners are or similar type, but we will try our best to promote industry cooperation with enterprises for more funding, promoting industrial competitiveness, and creating social benefits.

14. With regards to the quality/quantity of paper publication, UIUC is used (instead of Berkeley) as the direction for improvement. Regardless of UIUC in the suburb or Berkeley at the heart of high technology, the success of a university is not justified by the number of publications, but NTU still boasts its performance with paper publication.

A: Apart from advancement in paper publication quality and quantity, we have also cooperated with the enterprises for industry-university cooperation and technology transfer. We strongly encourage professors to cooperate with the industries and transfer technologies if their research results can be of any assistance to the industry or benefit social welfare and security. The total amount of industry-university cooperation projects in 2008, 2009, and 2010 were NT\$282,135,000, NT\$355,466,000, and NT\$422,405,000. Technology transfers and income derived from intellectual property rights in 2008, 2009, and 2010 were NT\$131,558,000 (79), NT\$68,552,000 (85), NT\$135,120,157 (101).

15. In the latest proposal, two more buildings (teaching and learning building phase two, excellence research building phase two, Humanities and Arts lecture hall and teachers dormitory, dormitory for international scholar, animal center, manufacturing center, and precision disposal factory) are to be established. However, the fame of a university lies not in a forest of tall buildings. Cambridge and Oxford in the UK serves good examples. Half page of report has been published in 2010 by UDN that the campus of NTU is like a construction site. This is worth thinking.

A: A complete software and hardware environment and infrastructure is among the most important elements necessary for the creation of the kind of environmentally-conscious, sustainable, high-quality campus environment required of an elite university, shaping a scenic campus benefitting a world-class university, as well as responding to the space demands of NTU's future development. Infrastructure

with urgent needs planned in phase one would be prioritized, with considerations for promoting teaching and research standard.

There are around 33,000 students and 2,000 full-time faculties in NTU. Due to higher education budget dilution, major constructions have been put to a halt, with insufficient space for teaching and research. The infrastructures listed in the proposal are indispensable for teaching and research. There are around 11,700 students at Cambridge and 4,000 hectares of campus area while NTU has around 33,000 students and 114 hectares of campus area in the main campus. The two cannot be compared. Every construction was passed under the guiding principle of NTU campus planning report through severe process. According to the control principle and basic principles for sustainable campus management in “2009 NTU campus plans team report (draft)”, campus planning should be reviewed by campus planning team committee for approval, submitted to university development plan committee for approval before construction. In terms of land development and architecture, we have severely requested construction unit to reduce noise pollutions or environmental pollutions to the minimum. As for environment inspection act, NTU has fully complied with the regulation, and has cooperated for inspection when necessary.

Would it do us justice to use the perspectives 20 to 30 years ago to observe the future development of NTU?

16. The listed objectives are the basis for acceptance check in the future, of which, ‘international’ includes teachers and students, and quality should be emphasized instead of just quantity.

A: Same as the response from number 5.

17. The concept of cloud should be introduced to campus facilities.

A: As an important part of the support for the university to become one of the world's top universities, the Computer and Information Networking Center (CINC) began the planning for providing compute and storage capacity and software as a service, provisioned from an on-demand processing platform that leverages economies of scale in 2010. The goal is to facilitate the university's academic research and teaching/learning with cloud computing. Phase 1 implementation was completed in December 2010 which included two racks of computing equipment and virtualization system, on-demand self-service web-based service applications, and automatic service provisioning and management system. In January 2011, two regulations have been approved by the university's administrative: “Regulations Governing NTU Computer and Computing Facility Subscription” (「國立臺灣大學計算機及資訊網路中心電腦設備與計算資源服務租(借)用管理辦法」) and “Regulations Governing Fees for NTU Cloud Services” (「國立臺灣大學計算機及資訊網路中心雲端計算資源服務收費辦法」). We will continue to plan for phase 2 implementation.

Cloud computing was partly evolved from the high performance computing (HPC) technology. In 2006, CINC set up the HPC center which currently has 468 computing nodes and 2134 cores, and a variety of scientific computing software packages. The center has served more than 90 research teams in six colleges and one university-level research center. Meantime, one academic program and two research centers were established: the “NTU-Trend Cloud Computing Program” (「雲端計算趨勢學程」) under the department of Computer Science and Information Engineering of the College of Electrical Engineering and Computer Science in 2009; the “Cloud Computing Research Center” (「雲端運算研究中心」) of the College of Electrical Engineering and Computer in July 2010; and the

“Cloud Computing and Business Research Center” of the College of Management in November 2010. These centers have received a number of cloud computing related equipment and funding from the industry.

18. National Taiwan University Hospital (NTUH) has an advantage in Biomedical Molecular Imaging, but with the sole involvement of Siemens and no domestic enterprises, it might be hard to become world top in long term. Corporate participation should be increased.

A: Molecular imaging is broadly defined as the characterization and measurement of biological processes in living animals, model systems and humans at the cellular and molecular level, using remote imaging detection methods. Molecular imaging research is to develop novel imaging technologies for interrogating molecular events in living objects, to understand molecular phenomena in diseases such as cancer, cardiovascular diseases, and neurology diseases, and to accelerate new discoveries in biology and medicine. The goals of the proposed Center program are to integrate the multidisciplinary resource inside National Taiwan University, to fundamentally change how biological research is performed from the molecular point of view with cells in their intact environment in living subjects, to develop personalized ways to diagnose diseases and monitor therapies in patients with higher sensitivity and specificity, to reduce mortality and to improve life quality, and the reduce unnecessary diagnosis and therapies. Research in this area will leverage both the nation’s bio-technology research and the biomedical imaging industry, providing a training ground for experts in medical imaging hardware utilization.

The Biomedical Molecular Imaging Core Laboratory, established in 2003, is one of the core labs in the Genomic Research Center supported by the first round of the Ministry of Education’s 5-year, 50 billion initiative. Seven PIs, coming from the Electrical Engineering and Computer Science (Chi-Kuang Sun, Paichi Li, Jyh-Horng Chen), Basic Science (Chen-Yuan Dong), Medicine (Fu-Hsiung Chang), Engineering (Chung-Ming Chen), and National Taiwan University Hospital (NTUH, Kai-Yuan Tzen), work together in the NTU Medical Center to integrate nano-medicine, antibody engineering related technologies and advanced imaging modalities for multidisciplinary biomedical researches toward the goal of early detection and effective therapy in this coming age of personalized medicine. Key research resources from relevant colleges were fully integrated and the core lab had thus established various animal and clinical molecular imaging platforms. These core facilities have comprehensive computerized reservation and charge systems to share some parts of its own operating expenses. As for the “current” funding sources, besides the resource from the NTU’s share of the 5-year, 50 billion budget (accounts for 7% of the total operating fee), the current running academic research programs supported from National Science Council and National Health Research Institute accounts for 50% of the research money (with a total of 116,680,000 NTD). The rest of the 43% current operating fee contributes from industrial-related programs (96,052,500 NTD). This does not include the technology transfer fee during the past 5 years (23,000,000 NTD). The developed technologies have attracted domestic and foreign enterprises to participate in our projects, including Yang-Tai Optronics (a subsidiary of Coretronic Corp.), Chung Hsin Electric & Machinery Mfg. Corp., and L’Oreal (France). Professor Pai-Chi Li from our research team is on secondment, which he holds the manager position at Yang-Tai Optronics. In 2010, Yang-Tai Optronics’s revenue had reached 750 millions. Through academia and industrial collaboration, Yang-Tai Optronics has transformed from a system assembly and testing company into a high-level system R&D company, and is one of the two companies in the world that develops high-frequency ultrasound system for pre-clinical usage. A

high-frequency ultrasound system is priced over 4 million NTD. Thus, a successful transition from OEM to a brand-name owner is accomplished. (Central News Agency reported.)

Taiwan's medical equipment industry and its output value have reached 60 billion NTD, among which the consumer electronic medical equipments are the main items of business. The market share of high-level biomedical imaging is very low. It is estimated that the market share of biomedical imaging (including molecular imaging) will reach 70 billion NTD before 2014. The healthcare reform bill passed in the United States, and gradual recovery of global economy and spending power in Europe and the United States have positive impact in Taiwan's biotechnology. These regions are important market for Taiwan's biotechnology and medical care industries.

In the second phase of the Aiming to the Top University project, NTU will fund the Molecular Imaging Center to expand and increase its collaboration with other non-NTU academic institutions and industrial companies. New center recruits many experts from different areas, including clinical medicine, biochemistry, molecular and cellular biology, optronics, ultrasound, nuclear medicine, nuclear magnetic resonance, electron microscopy, X-ray imaging technology, data processing and cloud computing. The objective of our center is to provide an earlier, more accurate and personalised medical diagnosis and thus, reduce the mortality of major diseases and improve the quality of life and healthcare for each individual. In addition, we will actively support our domestic high-level molecular biomedical imaging industry. The establishment of this center will integrate resources from cross-institutions, combine expertises and advantages from different faculties and establish management platform required for clinical trial. We aimed to become a global leading clinical research center for molecular imaging. We shall expand and attract participation from domestic companies, and to complete five or more TFDA cases within second phase of the Aiming To the Top University project. We hope that the outcomes from the actual clinical trials will not only improve the well-being of our people and rest of the world, but also promoting related local industries. The structure of the Center is shown in Figure 1. Technology wise, we will adopt and advance a wide range of molecular imaging technology, including PET, MRI, Ultrasound, light microscopy, electron microscopy, infrared imaging, THz (T-ray) imaging, and X-ray imaging, to be integrated with the molecular reporter design core and digital library core facilities. To solidify our promise toward clinical molecular imaging, new PIs from the College of Medicine and NTU Hospital will join the center and will be responsible for the active research toward molecular reporter design (Chyng-Yann Shiue, Ming-Fu Chang), digital library and imaging management (Jau-Min Wong), cardiovascular diseases (Tzung-Dau Wang, Lung-Chun Lin, Wen-Jen Lee), malignancies (King-Jen Chang, Chiun-Sheng Huang, Yeun-Chung Chang, Jason Chia-Hsien Cheng, Wen-Hong Kuo), neuro-psychiatric disorder, endocrinology (Tien-Chun Chang), and dermatology (Yi-Hua Liao). Besides the above listed core members, the College of Medicine and NTU Hospital will further support the new Center by establishing the Clinical Management Organization inside the Molecular Imaging Center while Dean Pan-Chyr Yang will serve as the chair of the advisory committee, to supervise the clinical studies. Prof. Ann-Lii Cheng (Chairman of the Department of Oncology, recipient of Academic Award from Ministry of Education) will serve as the chair of the Clinical Management Organization, to establish and train the clinical management team (including clinical trial managers and nurses) for the support of the clinical trials and to coordinate the involvement of clinical MD from NTU Hospital. The creation and management of the clinical trial platform will surely attract more participants not just from NTUH, but also from other domestic and

international research institute and industries.

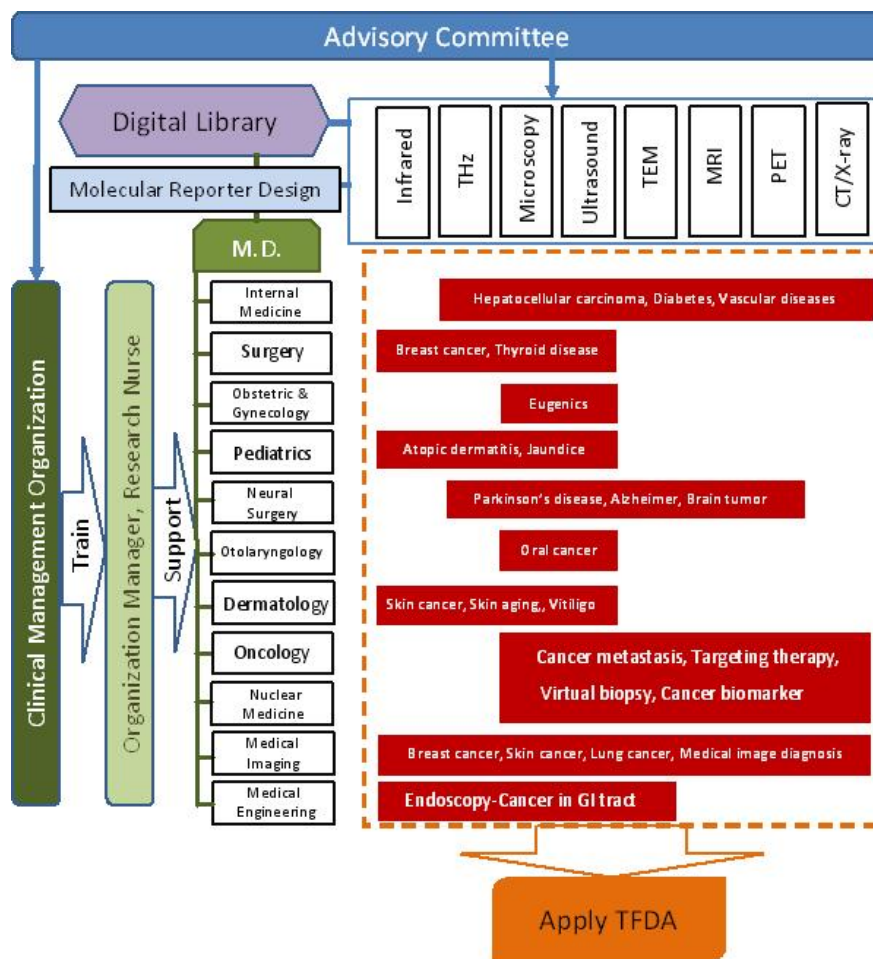


Figure 1: Structure of the NTU Molecular Imaging Center

Target in the off-campus domestic and international industries consists of L'Oreal, Acoustical Technologies (Singapore), IBM, GE, Siemens, Aurora, Bruker, Xilinx, HOPAX/SeeCure Biomedical Inc, Hwacom Systems Inc., Taiwan Liposome, Quanta Electronics, Yang Tai optoelectronics, East McNair Technology (Chi Mei Group), Hong Quan technology, Chung Hsin Electric & Machinery Mfg. Corp., BioSenseTek Corp., Canyon Biotechnology Co., Likuan Technology Corp., Keybond Technology Inc., SuperBIN Company, and ZTE Electrician. In addition to the current negotiations and cooperation teams, with the established clinical trial platform, we expected to attract more manufacturers to participate. In addition to clinical molecular imaging studies including the present three major markets, namely cardiovascular, cancer, neurological diseases, we will also cover the skin care (beauty and aging), allergies, metabolism/endocrinology and other emerging important medical issues. Among the upgraded 6 key emerging industries promoted by the Executive Yuan, health care and biotechnology are 2 of six key projects, thus including the critical medical imaging area. Recently Executive Yuan announced the taking off of the biotechnology industrial plan – with the Diamond action plan TFDA to promote the establishment of clinical trials platform. The Centre's objectives fully fit the Executive Yuan's policy direction for the application to take the lead TFDA exemplary role, bridging the gap between industry and research clients.

The center is expected to be at full speed in the next five years to promote research into the TFDA as follows: optical harmonic generation biopsy system for skin, optical harmonic generation biopsy

system for oral cavity, high-speed high-resolution nuclear magnetic resonance molecular imaging system, three-wavelength infrared imaging system for breast cancer detection, automatic three-dimensional ultrasound for breast cancer screening systems, portable ultrasound imaging system, positron emission tomography, and ^{18}F DOPA, 5- ^{18}F HTP, [^{18}F]FLT, [^{18}F]fluorocholin, [^{18}F]fallypride, ^{11}C -PIB (Pittsburgh compound B), ^{123}I -MIBG and other clinical trials of molecular imaging agents. In addition, the world leading systems for in vivo preclinical imaging will be developed, including the two-photon photoacoustic imaging systems and T-ray mammogram. The supply chain infrastructure including the IC, PCBA, cabling, tooling, ID, power module and the probe is now readily established in Taiwan. With the establishment of the clinical evaluation platform with The National Taiwan University Hospital, the objective environment will become more mature and will attract more capital investment into the domestic industry and re-investment from large companies, VC, Executive Yuan, and the mega fund. We believe the NTU Molecular Imaging Center will be the center of innovation and technology development and clinical trials, and will contribute to emerging biotechnology industry. We believe more than 500 high-value jobs will be created through our efforts in the next 5 years.