中華民國科學技術白皮書

White Paper on Science and Technology

¾ 科技發展遠景與策略

Visions and Strategies for the Development of Science and Technology

(2003 － 2006)

（簡要版 Executive Summary）

行政院國家科學委員會

National Science Council, Executive Yuan

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（民國九十二年至九十五年）

（中華民國九十三年一月七日行政院第二八七三次會議核定）

簡要版

邁入二十一世紀的頭幾年，全球經濟在成長減緩後方有復甦跡象時，美國卻面臨九一一恐怖主義襲擊及之後掀起的伊拉克反恐戰事。亞洲國家本是全球經濟復甦的主要寄望，卻被嚴重急性呼吸道症候群（SARS）打亂經濟成長腳步，影響並持續遍及全球。類似事件在全球進入經貿自由化，金融體制透明化，科技資訊快速發展及全球生態環境威脅的趨勢下相信仍會不斷的發生。

面對上述挑戰，各國均體認科技發展的重要性與急迫性，我國自不例外，二十世紀末（民國八十八年），政府為確立推動科技發展的方針與原則，通過並公布了「科學技術基本法」。該法第九條規定，政府應每兩年提出科學技術發展之遠景、策略及現況說明；第十條則規定，政府應每四年訂定國家科學技術發展計畫；基於科技發展的推動，需要時間與詳細措施規劃後落實執行，因此政府以每四年為一期的國家科學技術發展計畫來推動，但鑑於科技發展的日新月異，所以每兩年做一個總體檢，並勾繪適當的新遠景及更新策略。為進一步落實科技研發成果下放之立法意旨、提升科技研發創新、延攬境外優秀科技人才，政府九十二年修正通過「科學技術基本法」部分條文。

「科學技術基本法」公布後第一次的遠景、策略及現況，出現在九十年召開的第六次全國科學技術會議之後行政院通過的「國家科學技術發展計畫（民國九十年至九十三年）」中，第二次的遠景、策略及現況，則是本版「中華民國科學技術白皮書」（民國九十二年至九十五年）的主要架構，內容分為兩篇及附錄，第一篇「科學技術發展遠景與策略」涵括四章，第二篇「政府各部門科技發展」涵括十六章。我國科學技術發展之遠景、策略及現況說明，簡述於後。

邁向知識、創新、法制與全民的科技發展

透過知識經濟時代的挑戰與機會、國內外科技情勢的丕變及衝擊，未來政府應邁向一個重視科技經費、人力的投入與運用，加強知識創造與技術創新、推動法制化及科技組織體系彈性化，並發展攸關全民福祉的科技。

圖 1. 邁向知識、創新、法制與全民的科技發展

我國科學技術發展之現況

(一)民國九十一年全國研究發展總經費占 GDP 的比率 2.30 %，已達成「國家科學技術發展計畫」所訂中程目標（九十三年達到占 GDP2.3%的比率），惟距「挑戰 2008」所訂目標（達到占 GDP3%的比率）仍有一段差距，政府與民間仍應持續積極投入。

(二)近五年間大學學歷以上研究人員數成長約 20.36%，惟博士級研究人員數，尤其是企業界之博士級研究人員比例有待提升。

(三)民國八十七至八十九年間，我國員工人數 20 人以上企業則有 50.2%從事過技術創新活動，其中製造業之比例高於服務業，投入的技術創新經費平均占當年營業額 2.81%。

(四)我國在「科學引用文獻索引」（SCI）論文發表篇數排名，九十一年為第十八名（10,831 篇）。

(五)我國在「工程索引」（EI）論文發表篇數排名，九十一年為第十一名（5,350 篇）。

(六)我國在美國獲得專利核准數，民國九十一年為第四名（5,431 件）。

(七)在國家競爭力方面，依據 2003 年世界經濟論壇的研究，我國成長競爭力世界排名第五，科技排名第三。另，2003 年洛桑國際管理學院公布的研究報告，我國的整體競爭力排名第六。

(八)在學術研究方面，國科會針對學術研究補助的專題研究計畫，九十一年共核定經費約 116 億元，各學門均做完整之規劃與檢討，擬定符合國家需要與國際潮流的重點方向。

(九)政府科技計畫各領域均擬定研發重點，做為中、長期推動之依據，35 個領域科技發展計畫九十二年核定經費逾 300 億，對產業技術的提升影響很大。過去兩年已對其中的 26 個領域召開領域策略研討會，完成過去三年執行成效與研發能量之評估，以及未來發展方向之規劃。

(十)為因應國家社經重要議題，並結合上、中、下游科技資源，規劃執行的國家型科技計畫，目前共有防災、電信、農業生物技術、生技製藥、基因體醫學、數位典藏、晶片系統、奈米及數位學習等九個，九十二年核定的經費約 110 億元。

(十一)推動「大學學術追求卓越發展計畫」，區分兩梯次，全程各四年計畫進行中；待九十三年第一梯次計畫執行完成後，將展開另一波段全程四年的「大學學術追求卓越發展延續計畫」，完成後期能帶領學術界在優勢學術領域達成卓越。

從政府科技發展主要計畫及方案的產出，看出過去四十餘年政府科技政策的演進、科技發展的推動執行架構，及政府科技組織的體系。科技發展資源部分，我國研發總經費與先進國家相較稍低，因此政府與民間均應持續積極投入；我國研發人力近年已有明顯成長，惟博士級研究人員數，尤其是企業界之博士級研究人員比例有待提升。在科技成果方面，我國論文發表篇數及美國核准專利數排名已至高點，未來應往質的提升方面努力。在國家競爭力方面，依據世界經濟論壇與洛桑國際管理學院公布的研究報告，顯示我國有很好的競爭力，尤其科技潛力受到國際間的肯定。

為因應新時代的挑戰，行政院於民國九十一年五月起推動「挑戰 2008：國家發展重點計畫（2002-2007）」，以強化國家競爭力，提升我國至世界一流國家的地

位，建設台灣成為綠色矽島。其中與科技發展相關之計畫有文化創意產業發展計畫、國際創新研發基地計畫、產業高值化計畫、數位台灣計畫與營運總部計畫等五項；而隱含在其背後的意義是科技知識的蓄積與應用，研發能力的提升、新科技的應用與促進知識創新活動。

科學技術發展的遠景

投入與產出方面指標

(一)全國研發總經費至民國九十五年時占 GDP 的 3%為目標。

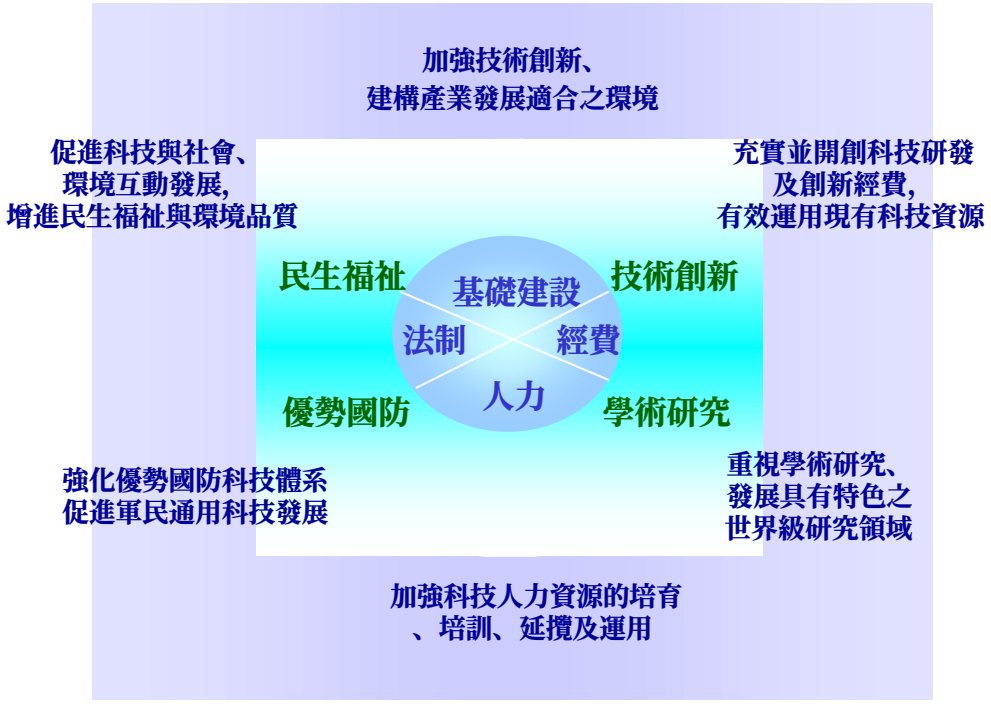
(二)每萬人口之大學以上研究人員數至民國九十六年時達 32 人年（全時約當數）。

(三)至 2013 年至少有一所大學成為世界一流大學。

(四)美國核准專利數（不含新式樣）至民國九十六年時，以達到核准總數 3.5%為目標。

(五)推動至民國九十六年寬頻用戶超過六百萬戶為目標。

圖 2. 科學技術發展遠景與策略核心概念



一、學術研究方面遠景

(一)學術研究環境提升至足以留住世界一流水準的研究人才。

(二)在重點領域培育出有卓越貢獻的大師級科技研究人員。

(三)自力發展出具有智慧與創造的學術研究，學術研究成果且能活用並協助產業發展。

(四)發展成為亞太地區具特色的學術研究與知識創造的重鎮。

二、產業技術方面遠景

(一)為製造業及服務業建構一個具國際競爭優勢的產業技術環境（例如適合產業技術的發明與大幅創新、適合新產業的培植、適合傳統產業升級創造高附加價值的環境等）。

(二)提高產業附加價值，建設台灣成為全球高附加價值產品的生產及供應中心。

(三)發展科學園區，整合地區研發資源，形成區域產業聚落。

三、民生福祉方面遠景

(一)發展成為一個能夠將科技研究成果回饋給社會的國家，國民藉著科技過得安心、安全、有品質的生活。

(二)發展成為一個國民終身學習養成，科技發展與生命倫理、人文社會和諧發展的國家。

(三)發展優勢國防科技與研發體系，落實國防科技工業厚植民間。

(四)科學或工業園區的發展與生活、永續結合，並以資訊通信系統相連成創新網路，形成綠色人文科技島。

科學技術發展的策略

為達成上述科技發展的遠景，擬定整體科技發展六大策略如下。至於策略下之詳細措施，則將待第七次全國科學技術會議，整體考量後詳細擬定。

一、加強科技人力資源的培育、培訓、延攬及運用

(一)人才為科技發展的根本，經建人力規劃應針對國家科技人才供需做中、長期之規劃，政府據之整合相關單位資源及擬訂彈性配套措施，有系統的培養各層次、各領域及跨領域專長之研發創新科技人員。

(二)對於國內人才欠缺的領域、或有前瞻性或高科技領域人才，一旦培育之人才不敷使用時，在政策上應積極由國外（包括大陸）延攬引進，研訂優遇延聘制度，突破相關法規或障礙，建構優質環境等配套措施，以留住所需科技人才。

(三)設計有效機制建立彈性科技人事制度，以推動產、官、學、研科技人才流通，落實研發創新、創業與團隊合作能力。

(四)推動全民科技教育，激發創新潛能，培育具發明創造力之科技人才，並建立大眾科技與人文之素養。

(五)為培養年輕研究人員及科技人員國際觀，鼓勵博士生、博士後研究人員及科技研究人員出國參與跨國或國際性合作研究計畫、前瞻關鍵技術移轉或各項科技合作活動，以厚植我國研究人員研究能力，使我國科技發展實力具國際競爭力並與全球接軌。

(六)檢討與改善技職教育體系，促進技職院校之合理發展。

(七)建立大專校院推動產學合作之依循，研訂大專校院產學合作辦法，協助解決教師參與產學合作之基本授課鐘點減免、年資採計、合理計畫案件數限制等之相關疑義。此外，研議設立國家級產學合作或技術移轉之傑出獎或卓越獎，及將產學合作執行績效納入大專校院評鑑，以期鼓勵大專校院優秀教師投身產學合作。

(八)研訂「專科以上學校以技術（實務）研發成果送審教師資格辦法」，建立大專校院教師以實務性研發成果申請升等之審查機制，以鼓勵實作能力之教師從事產學合作之意願，並以其產學合作之研發成果升等。

二、充實並開創科技研發及創新經費，有效運用現有科技資源

(一)除政府實現科技預算每年以 12%成長率為目標之既定政策外，為鼓勵民間積極投入研發及創新，政府應制定激勵或回饋等配套機制，開創新資源，以達成民國九十五年研發經費占 GDP 3%之目標。

(二)政府科技經費之配置應做多面向之檢討，例如從總體面、部會面、機構特性面、優先順序面、學術面、產業需求面、產學合作面及成果評估面等，進行檢討整合，以避免無效與重複投資；同時科技預算應注意研發及前瞻創新之比重，並將資源適當比例投注於有希望居世界領先地位之特定領域或關鍵技術。科技經費之管理、審議及績效評鑑應考量制度化及效率化。

(三)科技資源除研發與創新經費的投入與整合外，科技研發與創新環境的配合措施、科技組織體系與法制化等均應配合時代趨勢與環境變化，適度調整與改進。

(四)鬆綁法規，提供有效措施，鼓勵民間企業提高其研發經費。

三、重視學術研究、發展具有特色之世界級研究領域

(一)建構優質環境，吸引國外優秀學者與研究人員來台研究，並鼓勵跨國合作研究，引進並調適運用國外先進技術，使我國對人類知識創造做出實際貢獻。

(二)積極鼓勵前瞻性研究，重點推動尖端科學研究，鼓勵跨領域合作與長期性研究，應特別重視以創新性、突破性評估之研究成果，以發展具我國特色的研究領域，培養世界級大師，以獲得國際肯定。

(三)逐步調高基礎研究經費之投入比率，以確保應用研究及技術發展的創意源頭。

(四)學術研究成果質量並重，以能夠產生國際影響者為優先，亦應將研究成果在產業之應用效果納入考量。

(五)以「質的提升」做為學術研究補助策略之主軸，打破平頭式的補助方式，對傑出的研究者，給予長期而充裕的經費，以培育大師級之研究人員。

(六)規劃建立世界一流大學，並重點支持卓越研究型大學成為世界級研究中心。

四、加強技術創新、建構產業發展適合之環境

(一)健全適合高科技產業發展的環境，成為孕育科技創新的平台。

(二)開發產業核心技術，建立完整之重點產業規劃機制，運用大學及研究機構的資源。

(三)協助學研機構建立研發成果之智慧財產權保護及技術移轉機制，落實藏技於民。

(四)鼓勵產學研合作研究，並建構各種有利於技術交易的機制，加速研發成果商品化。

(五)增加對學研機構之誘因，加強整合並釋放研發能量至產業界，推動學研機構進行前瞻創新產業技術開發，重視專利產出，另將於行政院核定「經濟部產業科技研發轉型至突破創新方案」後，進一步推動跨部會產學合作會報。

(六)建設科學園區與其他智慧園區，發展具特色之產業聚落，同時重視兩岸產業分工與企業全球化趨勢。

(七)推動國際科技合作，促進人才與技術之交流，開發適於國內產業運用之技術。

(八)發展資通安全基礎建設，建置安全的資訊通信環境，提升產業競爭力。

(九)強化科技專案帶動民間增加研發投入及人才培育，鼓勵國內外企業在台設立研發中心，提供國防訓儲員額予業界參與產業技術研發，以及提供研發貸款。

五、促進科技與社會、環境互動發展，增進民生福祉與環境品質

(一)運用科技增進民生福祉與環境品質。

(二)重視並評估科技發展可能造成的影響，科技發展應該與其他社會系統和諧互動。

(三)重大科技研發投資，應廣泛爭取各社群的認同，同時融入全球科技社群。

(四)應用新科技於傳統文化的保存、終身學習與文化傳播。

六、強化優勢國防科技體系、促進軍民通用科技發展

(一)積極推動近、中、長程之國防科技發展策略規劃，以維繫國防科技發展之長期性與持續性。

(二)我國「國防自主」首重突破與掌握國防科技關鍵技術，國防科技發展政策應配合國家整體科技發展之規劃，提供國防科技投入研發人力與經費之資源分析，合理研訂國防科技發展指標，以集中有限的資源、重點突破國防科技關鍵技術。

(三)為充分運用軍方研發能量厚植民間，應儘速活化中科院等組織，融合國防科技、學術研究與民間產業等研究體系，強化軍民通用技術管理機制，透過技術移轉，積極落實軍民通用技術於民間，以推動國防科技發展，協助民間提升科技研發實力。

政府各部門科技發展

依據前述我國科技發展之遠景與策略，各部會署依組織任務擬定各部門之科技目標及策略，並透過資源規劃逐年推動。九十二年至九十五年間，十六個政府部門有關科技發展之資源規劃如表 1。

表 1.　九十二年至九十五年政府機關科技經費資源規劃

單位：百萬元

機　關	92 年度	93 年度	94 年度	95 年度	92-95 合計
中央研究院	5,843	6,708	7,513	8,415	28,479
科技顧問組	:	:	:	:	:
內政部	197	310	319	258	1,084
國防部	:	:	:	:	:
教育部	727	692	855	855	3,129
經濟部	24,383	28,982	31,861	35,047	120,273
交通部	674	808	970	1,165	3,617
衛生署	2,832	3,115	3,427	3,770	13,144
環保署	59	71	77	86	293
原能會	646	975	1,097	1,255	3,973
國科會	24,511	26,997	28,542	30,228	110,278
農委會	3,197	3,517	3,868	4,255	14,837
文建會	20	25	25	25	95
勞委會	143	173	187	201	704
工程會	55	62	64	65	246
故宮博物院	65	104	121	141	431

「:」：無數值

註：1.其中九十二年度為法定預算數，九十三至九十五年度之經費為估計數。

2.相關網址請參考「中華民國科技機構名錄」（網址：www.nsc.gov.tw/pub/yearbook）

White Paper on Science and Technology

Visions and Strategies for the Development of Science and Technology (2003 － 2006)

(Approved by the 2,873rd Meeting of the Executive Yuan on January 7, 2004)

Executive Summary

In the early years of the 21st century, just as the global economy began showing signs of recovering from recession, the events of September 11 in America and the ensuing war in Iraq thwarted all prospects of a global recovery. When the world turned its hopes to Asia for economic revival, the outbreak of Severe Acute Respiratory Syndrome (SARS) caused further economic disarray, spreading its effects around the world. Indeed, similar events are likely to occur as the world grows increasingly intertwined with trade liberalization, transparent monetary systems, rapid developments in technology information, and threats to the ecological environment – significant impacts on one region can spread quickly and affect many other parts of the world.

Confronted by these challenges, nations around the world are recognizing the importance and urgency of promoting science and technology, and Taiwan is no exception. In the late 20th century (1999), the government enacted the "Fundamental Science and Technology Act" to establish fundamental principles and directions for the development of science and technology. Article 9 of this Act calls for the government to present a written statement once every two years describing the visions, strategies, and current status of developments in science and technology; Article 10 stipulates the formulation of a National Science and Technology Development Plan once every four years. Since the promotion of scientific and technological development requires a timetable for the planning of specific measures and actual implementation, the National Science and Technology Development Plan shall operate on a four-year term, but an overall examination shall be conducted once every two years to update visions and strategies to stay current with rapid developments in science and technology. Also, the "Fundamental Science and Technology Act" was amended in 2003 to strengthen legislation governing research results, R&D and innovations, and the recruitment of sci-tech professionals from abroad.

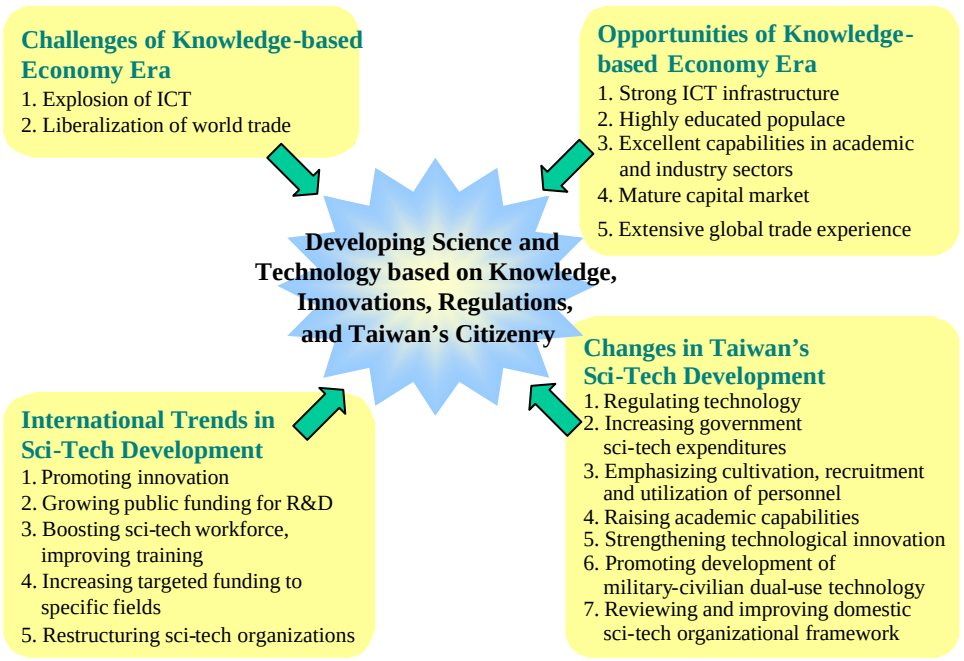
After the enactment of the "Fundamental Science and Technology Act," the first statement of visions, strategies, and current status appeared in the "National Science

and Technology Development Plan (2001~2004)," which was passed by the Executive Yuan following the Sixth National Science and Technology Conference in 2001. The second statement of visions, strategies and current status serves as the main framework for this compilation of the "ROC White Paper on Science and Technology (2003~2006)," which is divided into two main parts and an appendix section. Part One, "Visions and Strategies for the Development of Science and Technology," contains four chapters; Part Two contains 16 chapters on "Science and Technology Development at Government Agencies." The visions, strategies, and current status of Taiwan's scientific and technological development are briefly presented follows.

Developing Science and Technology Based on Knowledge, Innovations, Regulations, and Taiwan's Citizenry

To face the challenges and opportunities of the knowledge-based economy era and keep pace with major transformations in science and technology both at home and abroad, the government shall place more emphasis on sci-tech expenditures and manpower utilization, strengthen knowledge creation and technological innovation, put the legal system on a sound basis, enhance flexibility of the sci-tech system, and develop technologies that promote public welfare.

Figure 1. Developing Science and Technology Based on Knowledge, Innovations, Regulations, and Taiwan's Citizenry



The Current State of Science and Technology in Taiwan

1. Gross domestic expenditures on research and development accounted for 2.30% of GDP in 2002, already achieving the National Science and Technology Development Plan's mid-range goal (to reach 2.3% of GDP by 2004), but is still a considerable gap from the "Challenge 2008" plan's goal to reach 3% of GDP. Therefore, the government and private sector shall continue investing heavily in R&D.
2. Over the past five years, the number of researchers with university degrees or higher has increased significantly by approximately 20.36%, but researchers with Ph.D. degrees have grown slowly, especially in the industry sector.
3. From 1998 to 2000, 50.2% of employees in local enterprises with 20 or more employees had engaged in technological innovation activities, with the manufacturing sector outperforming the service sector. Enterprises spent an average 2.81% of current year revenues on technological innovation activities.
4. Taiwan ranked 18th in 2002 for the number of papers cited in Science Citation Index (SCI) with 10,831 articles.
5. Taiwan ranked 11th in 2002 for the number of papers cited in Engineering Index (EI) with 5,350 articles.
6. Taiwan ranked 4th in 2002 for the number of U.S. patents granted, earning 5,431 U.S. patents.
7. In terms of national competitiveness, the World Economic Forum (WEF) in 2003 ranked Taiwan 5th in the world for growth competitiveness, and 3rd for technology. Also in 2003, the International Institute for Management Development (IMD) ranked Taiwan 6th for overall performance.
8. Regarding academic research, the National Science Council approved approximately NT$11.6 billion in 2002 to fund academic research projects. After each discipline completed comprehensive planning and reviews of academic research, focal directions were mapped out in accordance with national needs and international trends.
9. The government has selected important areas in each field of science and technology as the basis for mid- and long-term plans to promote government sci-tech programs. In 2003, over NT$30.0 billion had been approved to support scientific and technological development programs in 35 fields, yielding enormous benefits to the industry. Over the past two years, Science and Technology Strategy Planning Sessions convened to assess administrative and R&D efforts over the past three years, and have mapped out future development directions for 26 of these fields.
10. To address the nation's major socio-economic issues, the government is integrating

resources across up-, mid-, and downstream levels to implement National Science and Technology Programs. In 2003, roughly NT$11.0 billion had been authorized for these programs, which include hazards mitigation, telecommunications, agricultural biotechnology, biotechnology and pharmaceuticals, genomic medicine, digital archives, system-on-chip, nanoscience and nanotechnology, and e-learning.

11. Projects under the "Program for Promoting Academic Excellence of Universities" have been divided into two batches, where each batch operates for four years. After projects from the first batch conclude in 2004, Phase II of the "Program for Promoting Academic Excellence of Universities" will begin operating for another four years. This program aims to achieve excellence in those academic fields where Taiwan has been particularly successful.

The government's major sci-tech programs and initiatives reflect the evolution of government sci-tech policy, the sci-tech promotion framework, and the government sci-tech organization over the past four decades. In terms of resources devoted to research and development, Taiwan's level of R&D expenditures is slightly lower than those of advanced countries, and government and private sectors shall therefore continue to invest heavily in R&D. And, the number of researchers with university degrees or above has grown significantly in recent years, except for researchers with Ph.D. degrees, whose growth has been particularly slow in the industry sector. In terms of research performance, Taiwan already ranks highly for the quantity of paper citations and U.S. patents, therefore future efforts shall focus on enhancing the quality of these works. In terms of national competitiveness, reports released by the World Economic Forum and the International Institute for Management Development indicate that Taiwan is a very competitive nation with global recognition for its scientific and technological capabilities.

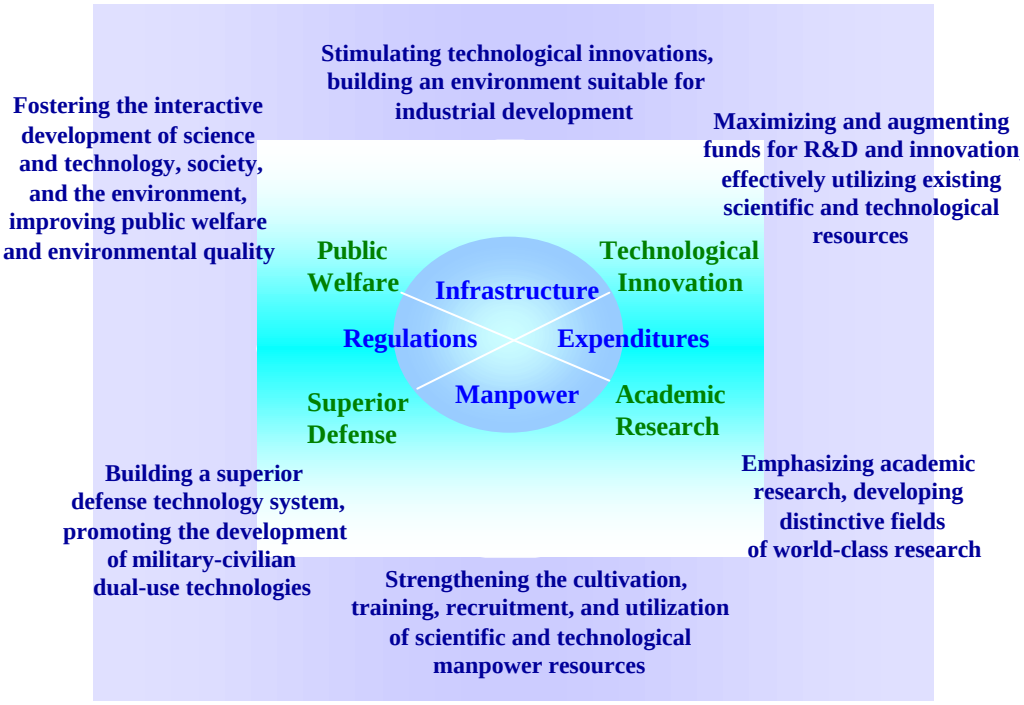
To respond to the challenges of a new era, the Executive Yuan has initiated the "Challenge 2008: National Development Plan (2002~2007)" to strengthen national competitiveness, elevate Taiwan to world-class standings, and transform it into a "Green Silicon Island." Within this overall plan, the individual plans that relate to science and technology include: the Cultural and Creative Industry Development Plan, International Innovation and R&D Base Plan, Industrial Value Heightening Plan, e-Taiwan Construction Plan, and Operations Headquarters Development Plan. The intentions underlying these plans are to accumulate and apply technological knowledge, enhance R&D capabilities, apply new technologies, and promote knowledge innovation activities.

Visions for the Development of Science and Technology

Indicators of Input and Output

1. Gross domestic R&D expenditures will account for 3% of GDP by 2006.
2. Research personnel (with university degrees or above) will constitute 32 person-years (FTE) out of every 10,000 persons in the general population by 2007.
3. At least one university will become a world-class university by 2013.
4. At least 3.5% of all U.S. patents granted (excluding new design) will go to R.O.C. applicants by 2007.
5. Over six million households will have broadband connections by 2007.

Figure 2. A Core Concept of Visions and Strategies for Sci-tech Development



I. Visions for Academic Research

1. The academic research environment will be improved to retain world-class research talent.
2. Accomplished research personnel capable of major contributions within certain fields will be cultivated.
3. Intelligent and creative academic research will be developed autonomously, and results will be exploited to assist industrial development.
4. Taiwan will transform into an academic research and knowledge creation hub in the Asia-Pacific region.

II. Visions for Industrial Technology

1. A competitive industrial technology environment will be created to offer international advantages in the manufacturing and service sectors (e.g., an environment suitable for inventions and significant innovations in industrial technology, for the cultivation of new industries, and for the enhancement of traditional high value-added industries, etc.)
2. Value-added industries will be enhanced, and Taiwan will develop into a global center for the manufacture and supply of high value-added products.
3. Science parks will be developed, and regional R&D resources will be integrated to form regional industry clusters.

III. Visions for Public Welfare

1. Taiwan will develop into a society that reaps the benefits of scientific and technological results. Citizens will draw on science and technology to lead peaceful, secure, and quality lifestyles.
2. Citizens will develop life-long learning habits, and there will be harmonious development among science and technology, ethics of life, culture, and society.
3. Superior national defense technology and R&D systems will be developed, and the civilian sector will be directly involved in the defense technology industry.
4. The development of science or industrial parks will integrate with living functions and sustainable development. Information and communication systems will merge and form innovation networks to create a green island of culture and technology.

Strategies for the Development of Science and Technology

To achieve the goals and visions described above, the following strategies for science and technology development have been established. Specific measures for these strategies will be formulated in detail after comprehensive reviews at the Seventh National Science and Technology Conference.

I. Strengthening the cultivation, training, recruitment, and utilization of scientific and technological manpower resources

1. Since human resources form the foundation of sci-tech development, government's mid- and long-range plans for personnel affairs will focus on the supply and demand needs of the nation's sci-tech workforce. These plans will serve as the basis for the government to integrate the manpower resources of relevant organizations, create flexible measures, and cultivate R&D and innovation personnel systematically at all levels and across all fields, including personnel with

multidisciplinary specializations.

2. When shortages of qualified domestic personnel occur within forefront research, high-tech fields, or other areas of science and technology, the government will take immediate action to recruit talent from overseas (including Mainland Chinese), and devise comprehensive measures to retain all necessary personnel by building attractive recruitment systems, breaking through relevant legislation or barriers, and creating favorable environments.
3. A flexible personnel affairs system will be created with effective mechanisms to promote the mobility of sci-tech workers among industry, government, academia, and research, and to harness the powers of R&D, innovations, entrepreneurship, and teamwork.
4. Sci-tech education for all citizens will be promoted to stimulate innovative potential, cultivate personnel with inventive and creative abilities, and increase the general public's capability in science and technology.
5. To expand the international perspectives of young researchers and sci-tech personnel, the government will encourage Ph.D. students, post-doctoral researchers, and sci-tech workers to travel abroad and participate in cross-national or international cooperative research projects, cutting-edge key technology transfers, or other collaborative activities in science and technology. These activities will strengthen domestic research abilities and empower Taiwan's sci-tech workforce with international competitiveness to connect with the world.
6. The vocational education system will be reviewed and enhanced to promote the proper development of vocational schools.
7. Colleges and universities will lay groundwork and establish guidelines to promote industry-university cooperation. Professors participating in industry-university cooperation will receive assistance in resolving such issues as reduction in the number of lecture hours required, calculation of seniority, and reasonable limits on the number of projects. National-level awards will be created for outstanding or excellent work in industry-university cooperation or technology transfers. The performance reviews of colleges and universities will evaluate results from industry-university cooperation so as to encourage more outstanding professors to engage in these activities.
8. The "Guidelines for Promoting Teachers of Junior Colleges or Higher Institutions through Technological (Practical) Research Achievements" will be established, creating a mechanism for college and university teachers who produce practical research results to qualify for academic promotions. This mechanism will motivate teachers with practical working abilities to engage in industry-university cooperation and produce research results that will also benefit their careers.

II. Maximizing and augmenting funds for R&D and innovation, effectively utilizing existing scientific and technological resources

1. The government will formulate policies to allow the sci-tech budget to grow at an annual rate of 12%. And, to stimulate greater investments in R&D and innovation in the private sector, the government will devise mechanisms to provide financial incentives or encourage feedback, and augment funding through new resources in order to raise R&D expenditures to 3% of GDP by 2006.
2. The government will evaluate its sci-tech budgeting scheme from multiple perspectives – including overall considerations, government agencies, uniqueness of organizations, priorities, academics, industrial needs, industry-university cooperation, and performance evaluation – and conduct integrated reviews to avoid ineffective and redundant investment. Moreover, the sci-tech budget will reflect the relative importance of R&D and cutting-edge innovation by devoting appropriate proportions of resources into promising fields or key technologies. Criteria of efficiency and systematization will be considered when administering, examining, and reviewing the effectiveness of sci-tech spending.
3. The government will integrate sci-tech resources and finance R&D and innovations. Moreover, the organizational framework, legal foundations, and measures relating to the R&D and innovations environment will be appropriately adjusted or improved to keep pace with modern trends and the changing environment.
4. Regulations will be eased, and appropriate measures will be taken to encourage higher R&D spending by enterprises in the private sector.

III. Emphasizing academic research, developing distinctive fields of world-class research

1. A favorable environment will be created to attract outstanding overseas scholars to conduct research in Taiwan, facilitate international collaborative research, and introduce and modify foreign advanced technologies for domestic use. These efforts will allow Taiwan to make practical contributions in the creation of knowledge for humanity.
2. The government will actively encourage forefront research, implement cutting-edge scientific research, and foster multidisciplinary collaboration and long-term research. Special emphasis will be placed on innovative and groundbreaking research achievements in order to develop distinctive fields, cultivate world-class professionals, and earn international recognition.
3. The proportion of expenditures devoted to basic research will be increased gradually to sustain the creative source of applied research and experimental development.
4. The quality and quantity of academic research results will be equally stressed with priority given to research topics with potential for international impact or industrial

applications.

5. The main strategy for subsidizing academic research will be "quality enhancement," breaking away from across-the-board funding and targeting outstanding researchers for generous and long-term funding to cultivate world-class researchers.
6. World-class universities will be established, and major support will be given to transform outstanding research-type universities into world-class research centers.

Ⅳ. Stimulating technological innovations, building an environment suitable for industrial development

1. Taiwan will foster an environment suitable for high-tech industrial development, and transform into a platform to nurture innovation.
2. Core industrial technologies will be developed, and a comprehensive mechanism to plan roadmaps for industries will be created using the resources of universities and research institutions.
3. Assistance will be given to universities and research institutions to establish mechanisms to protect intellectual property rights and technology transfers.
4. Collaborative efforts between industries, universities, and research communities will be encouraged, creating a variety of mechanisms to facilitate technology transactions, and expediting the commercialization of R&D results.
5. The government will introduce more incentives for universities and research institutions to strengthen integration with industries and apply R&D capabilities to the industrial sector. Universities and research institutes will be encouraged to develop forefront and innovative industrial technologies and produce patents. Also, cross-agency government meetings on industry-university collaborations will be further promoted after the Executive Yuan approves the "Ministry of Economic Affairs Plan for Converting Industrial R&D into Groundbreaking Innovations."
6. Science parks and other intelligent parks will be established to develop distinctive industrial clusters. Equal emphasis will be placed on the cross-strait division of labor as well as industrial trends towards globalization.
7. International sci-tech cooperation will be implemented to increase the mobility of personnel and technology. Technologies suitable for domestic industries will be developed.
8. Groundwork for security in information communications will be laid, and a secure information communications environment will be established to upgrade industrial competitiveness.
9. The government will strengthen sci-tech programs to stimulate more private sector investments in R&D and personnel training, and encourage domestic and overseas enterprises to establish R&D centers within Taiwan. Personnel serving national defense reserve duty will be able to participate in industrial technology R&D.

Loans for research and development will also be made available.

V. Fostering the interactive development of science and technology, society, and the environment, improving public welfare and environmental quality

1. Science and technology will be applied to the improvement of public welfare and environmental quality.
2. Potential impacts from sci-tech development will be studied with greater attention. Science and technology will develop in harmony with other societal systems.
3. Taiwan will gain the approval of all community groups for substantial investments in R&D, and also merge into the world's sci-tech communities.
4. New technologies will be used to preserve traditional culture, promote life-long learning, and disseminate culture to the public.

VI. Building a superior defense technology system, promoting the development of military-civilian dual-use technologies

1. The government will aggressively implement short-, mid-, and long-range strategic plans to develop national defense in order to maintain long-term and continuous development in this field.
2. Taiwan's "autonomous national defense" will aim to achieve breakthroughs and to harness key defense technologies. Policies on defense technology development will accommodate the nation's sci-tech development needs. To achieve significant advances in key defense technologies, inputs into defense technology R&D manpower and expenditures will be studied, and appropriate indicators of defense technology development will be defined to pool limited resources.
3. To optimize military R&D applications in the civilian sector, the structures of the Chung Shan Institute of Science and Technology and other organizations will be modified to integrate research systems from defense technology, academic research, and civilian industries. The mechanism managing dual-use technologies between the military and civilian sectors will be strengthened. Military-civil dual-use technologies will be vigorously applied to the civilian sector via technology transfers to promote the development of national defense technology, and enhance the R&D capabilities of the civilian sector.

Science and Technology Development at Government Agencies

Based on the overall goals, visions, and strategies previously described, each government agency will plan its own sci-tech goals and strategies in accordance with its organizational mission, and implement these efforts through the annual sci-tech budgets. Table 1 presents the sci-tech development spending plans for sixteen government agencies from 2003 through 2006.

Table 1. Sci-Tech Spending Plans for Government Agencies, 2003~2006

Unit: NT$ Millions

Agency	2003	2004	2005	2006	Total 2003~2006
Academia Sinica	5,843	6,708	7,513	8,415	28,479
Science and Technology Advisory Group	:	:	:	:	:
Minister of the Interior	197	310	319	258	1,084
Ministry of National Defense	:	:	:	:	:
Ministry of Education	727	692	855	855	3,129
Ministry of Economic Affairs	24,383	28,982	31,861	35,047	120,273
Ministry of Transportation and Communications	674	808	970	1,165	3,617
Department of Health	2,832	3,115	3,427	3,770	13,144
Environmental Protection Administration	59	71	77	86	293
Atomic Energy Council	646	975	1,097	1,255	3,973
National Science Council	24,511	26,997	28,542	30,228	110,278
Council of Agriculture	3,197	3,517	3,868	4,255	14,837
Council for Cultural Affairs	20	25	25	25	95
Council of Labor Affairs	143	173	187	201	704
Public Construction Commission	55	62	64	65	246
National Palace Museum	65	104	121	141	431

"**:**" - No data

Notes: 1. Figures for 2003 are legal budgets, figures for 2004 through 2006 are estimates.

2. Website addresses for these agencies are available in the directory of ROC sci-tech organizations (www.nsc.gov.tw/pub/yearbook).