<국제세미나 외국인 발표자 >

기조강연: Ashok Misra (인도공대 총장)
Director, Indian Institute of Technology
제목: 고등 기술 교육의 위기와 기회
"Challenges and opportunities in higher technical education"

Ph.D. Polymer Science & Engineering, University of Massachusetts 1974
M.S. Polymer Science & Engineering, University of Massachusetts 1971
M.S. Chemical Engineering, Tufts University 1969
B.Tech. Chemical Engineering, Indian Institute of Technology 1968

분과토의 I : Konrad Osterwalder (스위스 취리히연방공대 총장)
Rector, Swiss Federal Institute of Technology Zürich
제목: 대학발전비용: 누가 어떻게 치를 것인가
"University Development: Who will pay for it and how"

Ph.D. Theoretical Physics, the Swiss Federal Institute of Technology 1970

분과토의 I : TAN Eng Chye (싱가포르국립대 부총장)
Deputy President, National University of Singapore
제목: 대학의 기업화
"Corporatisation of a University"

Ph.D. and M.Sc. Mathematics, Yale University 1989
BA Mathematics (Honours), NUS 1985

분과토의 II : Krista Varantola (핀란드 탬페래대 총장)
Rector, The University of Tampere
제목: 핀란드 혁신 네트워크 내 대학의 역할-산학간 협력
"The Role of Universities in the Finnish Innovation Chain. Cooperation between Industry and Academia"

Ph.D. English Philology, University of Turku, 1985
MA English Philology, University of Turku, 1969
BA English Philology, University of Turku, 1968

분과토의Ⅱ: Anders Flodström (스웨덴 왕립공대 총장)
President, The Royal Institute of Technology
제목: 전세계 혁신 체제하에서의 대학의 역할 - 우리는 (대학) 권한의 전세계적 위기를 맞고 있는가?
"The Role of Universities in the Global Innovation System - are we facing a global Crisis of Competence?"

Ph.D. Surface Physics, Linköoping University 1975
M.Sc. Engineering Physics and Electrical Engineering, Linköoping University 1970

<국제세미나 외국인 발표자 소속 대학>

구분	국가	대학명	참고내용
기조강연	인도	인도공대	○설립: 1958년 ○2006년 The Times誌 선정 대학순위 57위, 공과대학 순위 3위
분과 I	스위스	취리히연방공대	○설립: 1854년 ○2006 The Times誌 선정 대학순위 24위, 공과대학 순위 12위, ○아인슈타인 등 노벨상 수상자 21명 배출
분과 I	싱가포르	싱가포르국립대	○설립: 1905년 ○2006년 The Times誌 선정 대학순위 19위, 공과대학 순위 8위
분과Ⅱ	핀란드	탬페래대	○설립: 1925년 ○핀란드, 2006년 IMD 국가경쟁력 순위 10위, 고등교육분야 순위 1위
분과Ⅱ	스웨덴	왕립공대	○설립: 1827년 ○2006년 The Times誌 선정 공과대학 순위 53위

1. 인도공대

카라그푸르, 뭄바이, 뉴델리, 첸나이, 루르키, 칸푸르, 구와하티 등 7개 캠퍼스로 이뤄진 인도공대(IIT)는 미국의 MIT와 비교될 정도로 경쟁력 있는 공과대학이다. 초대 수상 네루가 인도의 장래를 짊어지고 나갈 젊은 인재들을 길러내기 위해 1951년 캘커타 북쪽의 카라그푸르에 IIT를 설립한 것이 시초이며, 매년 1000만명이 넘는 고교 졸업생 가운데 수백명만이 입학할 정도로 경쟁률이 높다. 졸업생의 1/3 정도가 해외 업체에 스카웃될 정도로 IT 분야에서 실력을 인정받고 있으며, 이들이 미국의 실리콘밸리를 인도의 식민지로 만들어버렸다는 말이 나올 정도이다. 인도 정부가 70%의 예산을 지원하지만 교수·과학자·기업인들로 구성된 이사회에 모든 권한이 있으며, 대학자율의 입시(JEE)로 수재들을 뽑고 있다.

2. 스위스 취리히연방공대

20여 명의 노벨상 수상자를 배출할 만큼 기초과학 분야에서는 세계적 수준을 자랑하는 스위스의 이공계 대학은 정부와 산업체의 전폭적 지원을 받고 있다. 아인슈타인이 졸업한 취리히연방공대(ETHZ)는 총예산의 90%를 정부가 지원하고 있으며 연구·강의시설이 세계 최고 수준이지만 등록금은 1년에 채 100만원도 되지 않는다. 스위스 정부와 취리히연방공대는 2006년부터 신개념의 이공계 캠퍼스인 '사이언스 시티(Science City)' 구축을 계획 중이며, 이를 위해 취리히연방공대는 정부의 재정 지원은 물론 민간 투자 유치를 위해 다양한 노력을 기울이고 있다.

3. 싱가포르국립대

싱가포르국립대(NUS)는 미국의 프린스턴대, 코넬대 등 명문대학에 견줄 만한 아시아 최고 수준의 대학이다. 교수의 절반 이상이 외국인이고 70여 개국 학생들이 유학을 오는 등 국제적인 경쟁력을 갖추고 있으며, 미국의 실리콘밸리와 바이오밸리, 중국 상하이 등 세 곳에 해외분교를 운영 중이고, 30여 개의 명문대학과 공동학위제·학점공유제를 운영하고 있다. 이공계의 경우, 휴렛팩커드를 비롯한 글로벌기업들과 매년 2천건 이상의 공동연구과제를 수행하고 있으며, 'NUS 지주회사'를 통해 자(子)회사 격인 '사요반'(校辯·대학에서 설립한 기업)을 22개나 운영하는 등 완벽한 산학협력체제를 구축하고 있다.

4. 핀란드 탬페래대

1972년 헬싱키공대에서 정보통신기술 특성화 대학으로 분리한 탬페래대는 정보기술의 미래를 예측하고 정보커뮤니케이션학과를 신설, 집중투자하여 정원의 10% 이상을 IT 전문가로 배출하고 있다. 1970년대 중반부터 특성화를 선언한 탬페래대는 1980년대 노키아와 손잡고 손잡고 탬페래시에 R&D센터를 설립하여 전문인력을 양성하였고, 이후 탬페래시는 이동통신의 메카로 자리잡았다. 탬페래대 인근에는 노키아를 비롯한 이동통신 관련 기업들의 R&D센터가 밀집해 있는데, 이 대학에서 IT 분야를 공부하는 학생들 대부분이 기업 관련 연구소와 관련을 맺고 있으며 졸업 후 100%의 취업률을 자랑한다.

5. 스웨덴 왕립공대

175년 역사를 자랑하는 스웨덴 왕립공대(KTH)는 프랑스의 에꼴 폴리테크닉, 독일의 아헨공대 등과 더불어 유럽이 자랑하는 명실상부한 유럽 최고의 과학기술대학이다. '실용중시를 통한 명성획득(popular as well as practical)'을 목표로 이공계 분야에 집중 투자하고 있는 이 대학은, 정부에서 총장을 임명하며 예산의 80%를 지원하고 있다. 하지만 대학의 자율권은 철저히 보장받고 있으며, 모든 사업과 연구에 대한 결정은 교수진으로 구성된 교내통치위원회(internal governance)에서 이뤄진다. 정부의 전폭적 지지와 대학 자율권의 보장이 스웨덴 왕립공대 발전의 원동력이라 평가받고 있으며, 현재 에릭슨 등 700여 기업이 밀집해 있는 시스타 '사이언스 시티(Science City)'에 스톡홀름대와 공동으로 IT 대학과 연구소를 설립하여 유능한 전문인력을 배출하고 있다.

25th Anniversary International Seminar

Korean Council for University Education

CHALLENGES AND OPPORTUNITIES IN HIGHER TECHNICAL EDUCATION

Professor Ashok Misra

Director, IIT Bombay

Indian Institute of Technology Bombay

Globalization

1. Globalization is a term used to sum up the contemporary world order. Initially globalization was referred to in the domain of economics
2. The advances in information technology and the speed of communications have made our world a global village
3. The convenience of travel has brought people all over the world closer
4. Barriers of time and space have compressed. This has linked lives of people more intensely and at a faster rate than ever before
5. There is an increased movement of knowledge, ideas, good and money across natural borders
6. Globalization has increased interactions between nations in the areas of economics, politics, society and education
7. The Society has expanded and today its scope covers the nations and the world. In other words, we are now living in a globalized world
8. Today globalization embraces all sections of the society and its people – their lives, their livelihood, their interactions and really speaking almost all aspects of life in the present era

Globalization and the Knowledge Economy

- The advances in technology has led to Globalization and increased the power of Knowledge
- The current era is often referred as Knowledge Economy and the Knowledge Economy is by its nature global
- Advances is productivity are increasingly based on knowledge and learning – and since knowledge once disclosed spreads faster than capital or people – the economy becomes global since its resources are global
- All countries benefit when new knowledge is internationally shared
- Role of Higher Education will assume an increased role and significance than ever before in the Knowledge Economy

Higher Education

- In today's world, the Institution or University has to have global standards.
- What does this mean?
  1. Students must be aware of the knowledge that is being transmitted to their counterparts in other parts of the world – in China, USA, Australia, Finland, Korea and so on
  2. Teaching standards have to be as good as anywhere else in the world
  3. Students must be able to adjust to jobs in different parts of the world
  4. Keeping in view that students in one country may be employed in another country, cross-cultural aspects should be part of the curriculum

Higher Education

1. Higher Education is the backbone of a country's future
2. Institutions of higher education are temples of learning, where knowledge is transmitted and new knowledge is created
3. The country that has a superior higher education system has the edge in today's knowledge centric world.
4. Education and research are thus at the heart of the new economy
5. Greater stress on Creativity and Innovation is essential

Globalization and Higher Education

The development of universities with global standards is based on Knowledge and people.

- Knowledge requires people
- It is the people, not capital or other resources, who are at the heart of the knowledge economy
- Outstanding faculty at a university will attract outstanding students and research funds
- In the knowledge economy, productivity is based on innovation, requiring a wide range of people with specialized knowledge and experience
- Investment in people should hold a central place in a country's long term economic strategy

Higher Technical Education

- Provides quality manpower for the technological growth of a country for – design, development, research……
- Requires sound base of sciences, including biological sciences
- Requires excellent teachers
- Requires synergistic interactions with the industry
- Develops cross-disciplinary areas within science & technology
- Promotes interactions with other fields such as economics, business administration, finance, law, entrepreneurship etc.

Challenges in Higher Education

- Develop Vision and Strategy
- Attract and retain high quality faculty
- Attract high quality students at all levels
- Develop and periodically update Curriculum
- Provide the ambiance and facilities for high class research
- Develop an appropriate funding model

Higher Education in India

Indian Institute of Technology
Bombay

India Defies Generalisation

- Amazing scale and diversity of India
- 11th largest economy, 6th largest CO_2 emitter!
- IT, Space, Atomic Energy & Telecom growing rapidly
- Economy growing steadily at 8 to 10%
- Manufacturing set to grow at 12 to 15%
- Foreign exchange reserves ~ $2.6 trillion, about 60% increase over the past three years
- Poverty amidst plenty – a serious concern

Youth in India

- By 2030 the world population will be up by 2b – 95% in developing countries
  - By 2050, India will have 25% of world's graduates!
  - Need to find creative employment
  - SMEs, employment and global competition
- Need to enhance the quality and reach of education
- Need to increase innovation, competetiveness and entrepreneurship

India - 335 Universities

TYPE	No.	QUALITY
National Importance	13	Excellent
Deemed	91	Variable
Central	20	Good
State	204	Poor - Average
Private	7	Average

The challenge is to enhance the quality in all institutions

Comparison of Number of Universities

Country	Population in millions	Number of Universities	Number India needs for parity
India	1100	335	335
Korea	49	120	2900
UK	50	170	3700
USA	280	1800	7000

Opportunity for the growth of higher education in India is enormous

Science & Technology Education in India

- Pt. Jawahar Lal Nehru – 1st Prime Minister had a vision to make India self sufficient in her Scientific and Technological needs
- Produce manpower to carry out research, development, design for industrial & technological growth
- Inculcate a “Scientific Temper” in the country → attract the best talent for Science & Technology
- Create Institutions that would provide the required ambiance for Education & Research

Through Pandit Nehru's Vision

- The Indian Institutes of Technologies were set up
- Tata Institute of Fundamental Research started
- Bhabha Atomic Research Centre established
- Indian Institute of Science received a further boost
- Council for Scientific & Industrial Research – set up several labs

These initiatives led to the growth of Science & Technology and Education & Research in India

Some Statistics

Education achievements and challenges – in all subjects

People with a high school certificate	>	250 million
Those with a Bachelors degree	>	50 million
Bachelors in Science & Technology	>	10 million
Post-graduates in Sc. & Tech.	>	2 million
Doctorate in Sc. & Tech.	=	0.1 million

Enrolments – over the past 5 years

	Science	1.9m	→	3.5 m
Bachelors				
	Engineering	0.4	→	1.2 m

Today ≈ 4m students graduate with science in high school

Let us say 10% of high quality = 0.4m → 400,000

Quality institutions in India can cater to much less than this

Engineering Institutions in India

1. The IITs have made a global impact through their teaching programmes over the past 40 – 50 year
2. They still have to make a global impact in research
3. Challenge → Continuously update the curriculum
4. The scene in India is quite unique. We have a very large number of high quality aspirants of world standards for higher Technical Education

   However, the number of Engineering colleges of global standards are not sufficient in number

Engineering Institutions in India

7 IITs' student intake	≈ 5000/yr
18 National Institutes of Tech.	≈ 10,000/yr
A few of reasonably good standard	≈ 5000/yr
	Total ≈ 20,000/yr

Total graduating per year	≈ 400,000
Quality of teaching an issue	
Faculty availability	→ a serious problem
Inadequate level of research culture	→ serious concern

IITs & their Status

1. Excellent Bachelors & Masters level programmes
2. Research focus enhanced in recent years.
   e.g. Ph.D. enrolment at IIT Bombay increased from 700 < to >1300 over the past 5 years
3. Increasing focus on Innovation & Creativity
4. Technology Incubation
5. Enhancing interactions with the Industry
6. Excellent relationship & networking with Alumni

   → giving back to enhance the excellence

   → Faculty Alumni network

IIT System Challenges

→ Enhance the enrolments at B.Tech. level

Today at IIT Bombay	- 5300 students
B.Tech. + dual degree	- 2300
Masters	- 1750
Ph.D.	- 1250

→ Recruit and retain high quality Faculty

→ Enhance Research excellence

II Challenges and Opportunities

Indian Institute of Technology
Bombay

Issues to be Addressed

1. ICT to enhance reach and quality of learning
2. Faculty compensation
3. Innovation, Competitiveness & Entrepreneurship
4. Internationalisation
5. Governance
6. Increased investment in education

Issues to be Addressed

7. Offering the youth rewarding careers
8. Improving healthcare
9. Managing 12% growth in manufacturing with significant increase in employment (SMEs?)
10. Pulling 80 million people out of poverty
11. Improving infrastructure
12. Formulating policies to sustain growth

Today's University

- Has to be flexible with fast changing environment
- Change Management is of utmost importance
- Opportunities for Faculty development
- Ambiance for Student development

Governance issues

1. Address autonomy related issues
2. Attract funding – augment government from funding to the extent possible
3. Address fee related issues. How much should an institute charge?
4. Address responsibility related issues, especially in developing countries

Students

- Today's youth is different than say 2 decades ago. They have exposure to Information Technology, electronic gadgets and are used to multi-tasking
- The teacher-student relationship has to more of a partnership in the teaching- learning process

Curriculum

- Proactive – to be updated frequently
- Innovative – to capture the student imagination
- Flexible – to provide cross-disciplinary programmes
- To suit the needs of the industry and society

Web-enabled Learning

- For transmission of a large number of UG and PG courses across the nation. This is an opportunity which has a great potential for enhancing Technical Education
- Continuing Education Programmes through distance learning mode

Research Focus

- Research to be given a high priority
- Update research facilities to be at the cutting edge
- Enhance University-Industry collaborations
- Commercial research for industrial development
- Create Intellectual Property
- Develop a research strategy

Industry - Technical Institution Interaction

With globalization, industry would utilize the expertise and the intellectual capital in Universities to give them a competitive edge.

This would manifest in

- Generation of new knowledge
- Generation of new intellectual property in the form of patents, copyrights, etc.
- Development of new practices and processes
- Technology Transfer

Role of Industry

- Industries are getting global, they should share this with educational institutions
- Fund fundamental research relevant to development of new knowledge
- Industries should become active partners in the growth of Higher Technical Education

Entrepreneurship

Universities to have an ambiance where innovations and creativity flourish. A logical follow up is technology business incubators, innovation centres and research parks

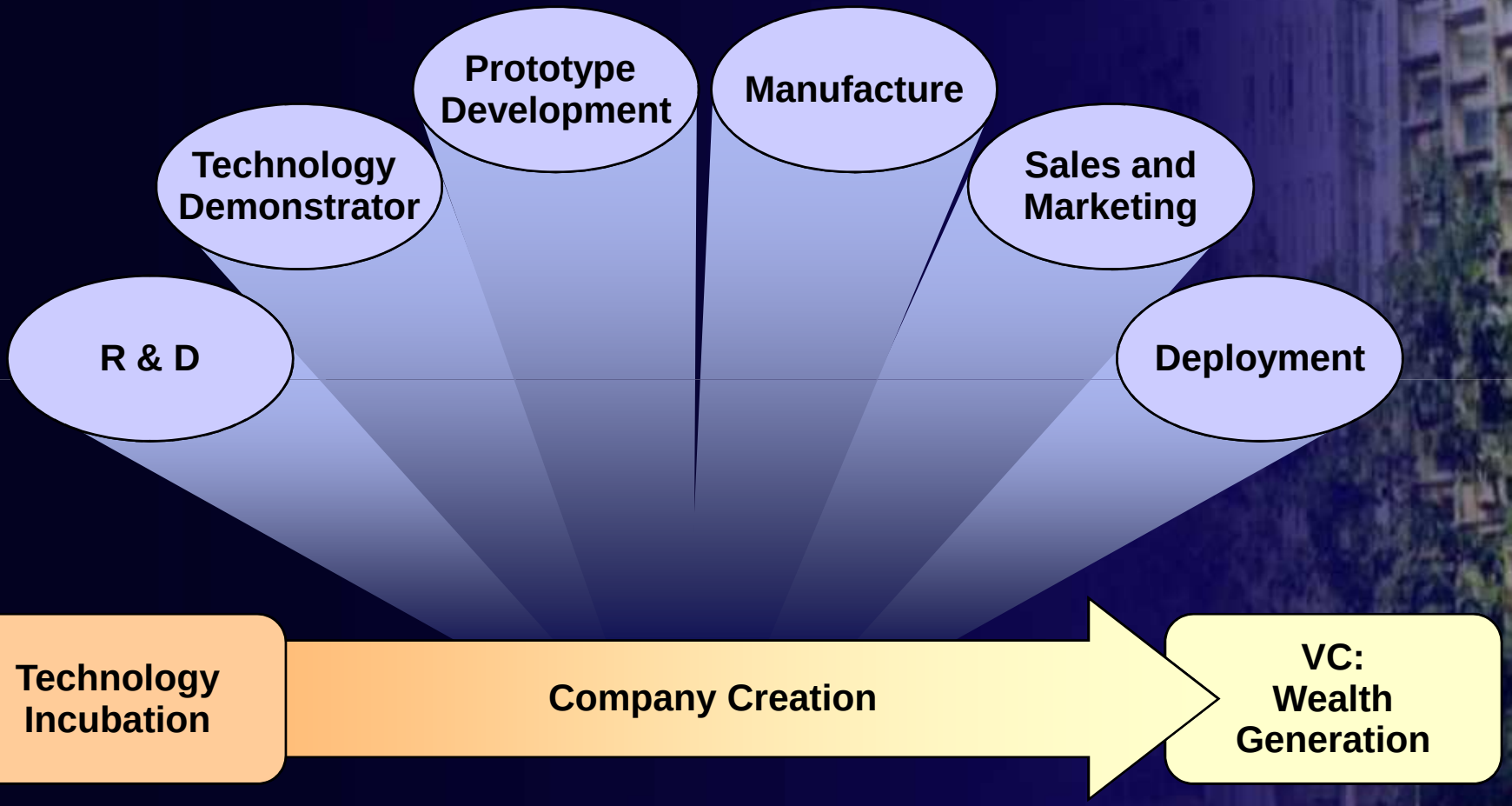
Venture capitalists should flock around the campuses in search of projects of commercial value

Requires a high level of research focus and development of new ideas worthy of commercialization

Such universities would provide opportunities for the growth of new enterprises, employment and contribute to the economy of the nation

This will attract high quality faculty and students

From Concept to Deployment



University interactions

- Compete for resources
  - Students
  - Faculty
  - Funding

- Cooperate with each other to address and work on solutions for problems and challenges for mankind. For example, in the area of
  - Energy
  - Environment
  - Water
  - Food security
  - Health – specially communicable diseases

International Collaborations

Broaden the faculty and student activities and experiences through international collaboration – an important requirement towards globalization.

- Exchange of Faculty
- Exchange of Students
- Collaborative bidding for high end projects
- Identify future areas in Science and Technology
- Setting up of Research Centres Jointly
- Jointly offering degree programmes
- Help neighbouring countries

Education can be globalized in several ways

- By setting up educational campuses abroad by Indian institutions
- By having foreign institutions set up campuses in India
- By offering educational programmes in foreign countries through tie-ups or collaborations.
- Through Distance Education Programmes
- By admitting foreign students in our institutions, for degree courses or as exchange students
- By having faculty from well known international institutes to teach and collaborate in research activities

Fund raising in Universities

- Universities present noble goals of education and research
- Many Universities were created by philanthropy
- Donations add value and help in enhancing excellence at all levels
- Donations should not be seen as a substitute for regular funding

Fund Raising

- Essential for future of the University in its pursuit of excellence
- Professionalize fund-raising
- Promote increased funding to higher education
- Build endowments – specially from alumni and industry through regular donations
- Develop the culture for attracting sustained donations

Fund raising from Alumni

- Recognize success and achievements of alumni
- Inform alumni of growth and successes at the University
- Develop networks from the University and alumni for fund raising
- Recognize donors by spreading the news
- Build donor and volunteer relationships
- Build teams and strategies to seek donation

Modern university to focus on

- High quality education of global standard
- Research and Development
- Innovation and creativity
- Entrepreneurship
- International cooperation
- Industry – University interactions
- New models for fund raising

Clearly, globalization has had an impact and will continue to impact Higher Technical Education – offering an enormous opportunities.


Indian Institute of Technology Bombay
Thank You

University development: Who will pay for it and how

Prof. Dr. Konrad Osterwalder,
Rector and President
Swiss Federal Institute of Technology (ETH)
Zürich, Switzerland

Over the last 50 years the percentage of a cohort getting a university education has grown tremendously in most European countries and in countries of other continents as well. An example is Switzerland, where in the fifties not more than 2% of a cohort made it to a university, while nowadays this figure is over 20%, an increase by a factor of ten. But still, in other European countries this figure is more than double; in the USA it is over 50%.
At the same time the total expenditure on higher education has grown much less, leading to what today are the overpopulated universities with student faculty ratios of 150 to one and worse.
The problem of funding higher education needs some rethinking. The relative importance of the sources of funding has to be reconsidered: public and private (students and private enterprises, organizations, etc.). Absolute levels of income for universities have to be increased and the sources of income have to be diversified. In this process the drive for excellence has to be strengthened and the fiction, that all higher education institutions of a country are “equal” should be given up. A good balance between basic funding and competitive funding has to be found: long term projects must still be possible. Project bound financing will have to be limited to topics of basic importance, free research has a much better chance of producing real innovations and discoveries. Academic autonomy is crucial, in particular at top institutions. Performance-based budgeting acts as automatic money distribution machine instead of governance and strategic management. The culture of higher education asks for mechanisms that help to improve performance: evaluation (self-assessment and peer review) and accountability.

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

University development: Who will pay for it and how?

Prof. Dr. Konrad Osterwalder
Rector and President ETH Zürich

© ETH Zürich

Topics

- Switzerland and its Higher Education System
- ETH Zürich
- Sources of funding: today
- Times of change
  - Direct funding: budgetary developments
  - Competitive funding: performance based
  - Steering effects and quality
  - Competitive funding: Project based
  - Earmarked funds
- More funds for the best
- New sources of funding

A story of Mr. Nobody

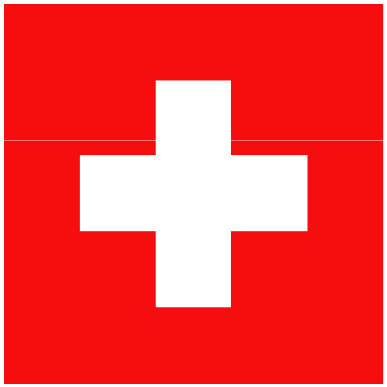
An old friend he had not seen in a while, greeted Mr. Nobody with the words:

„You haven't changed a bit“.

„Oh“, said Mr. Nobody and went pale.

Switzerland

Population	7’500’000 (foreigners 20%)
Area	40’000 km^2
Languages	63.7% German
	20.4% French
	6.4% Italian
	0.5% Romansh
	9.0% other
GDP	450’000 million CHF



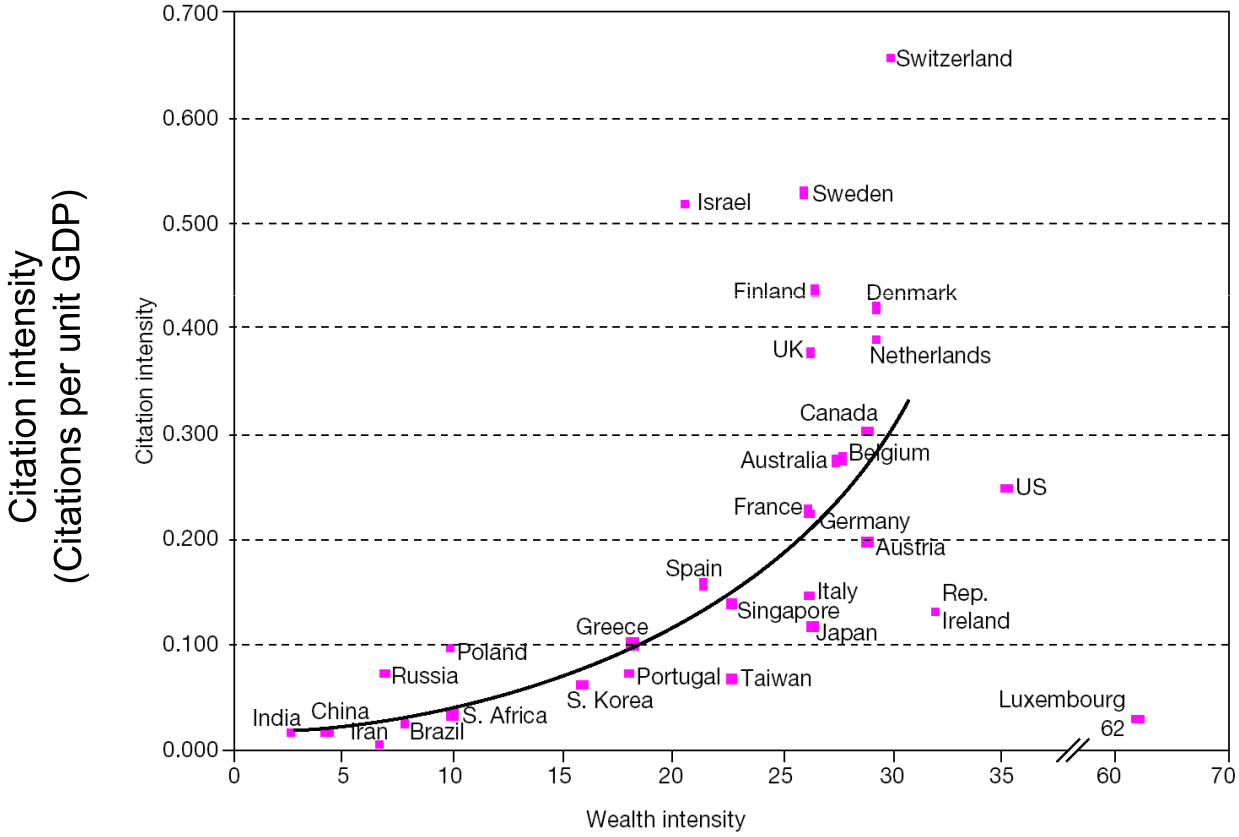
Swiss University System

- **Cantonal Universities**
- Geneva
- Lausanne
- Neuchâtel
- Fribourg
- Berne
- Basel
- **Zurich**
- Lucerne
- St. Gallen
- Lugano

- **Federal Institutions**
- EPF Lausanne
- ETH Zurich

- **+ 7 Universities of applied sciences („Fachhochschulen“)**

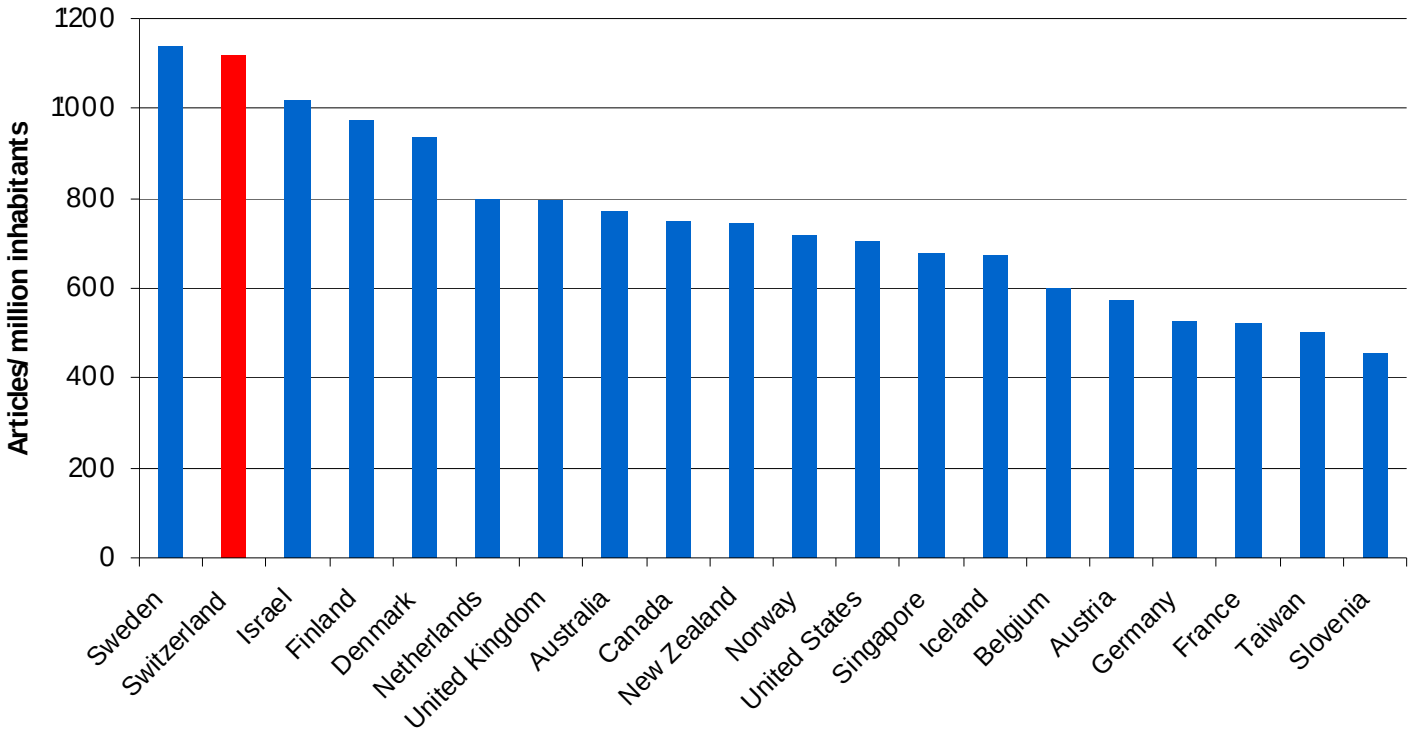
Economic vs. Scientific Wealth



Source: Nature. Vol 430. 15 July 2004

Per Capita Output of S&E Articles by Country

(2000-2003)



SOURCE: Science and Engineering Indicators 2006, National Science Board, USA
NOTES: Countries ranked by average per-capita S&E article output for 2000–2003. Articles on fractional-count basis.

Swiss Federal Institute of Technology:

ETH Zürich

Structure: 16 plus 1 Departments

Construction and Geomatics (2)

Architecture; Building, Environment and Geomatics.

Engineering Sciences (5)

Mechanical and Process Engineering; Information Technology and Electrical Engineering; Computer Sciences; Materials; Industrial Management and Manufacturing.

Natural Sciences and Mathematics (4)

Mathematics; Physics; Chemistry; Biology.

System-Oriented Sciences (5)

Earth Sciences; Environmental Sciences; Applied Biosciences; Agricultural and Food Sciences; Forest Sciences.

Humanities, Social and Political Sciences (1)

Humanities, Social and Political Sciences.

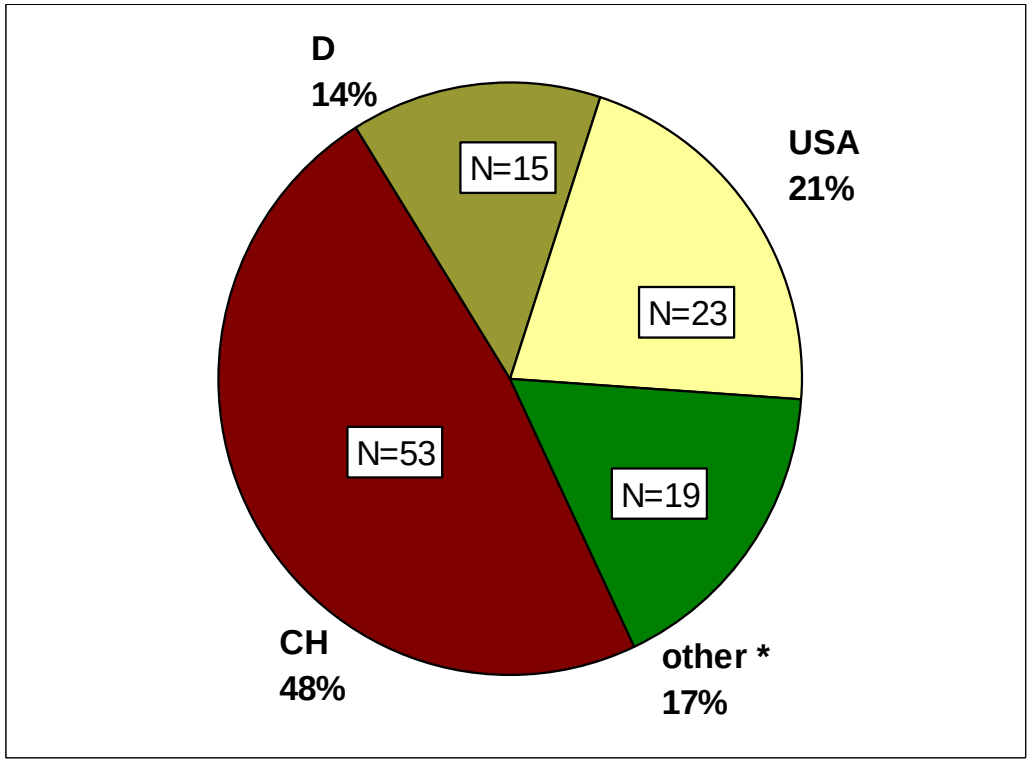
Facts and Figures (2005)

Bachelor-, Master- und Diploma students	**9672**
Foreigners	1264 (13%)
PhD / MAS/MBA students	**3033**
Foreigners	1585 (52%)
Professors (in FTE)	**349**
Foreigners	209 (60%)
Administrative and technical personel (FTE)	**6009**
Total costs	**1157 Mio CHF**
Third party funding	180 Mio CHF

International University

- Staff members from 80 nations
- > 50% of PhD students from abroad
- > 50% of professors from abroad

New Faculty 1998-2001 ©OK
Recruited from:

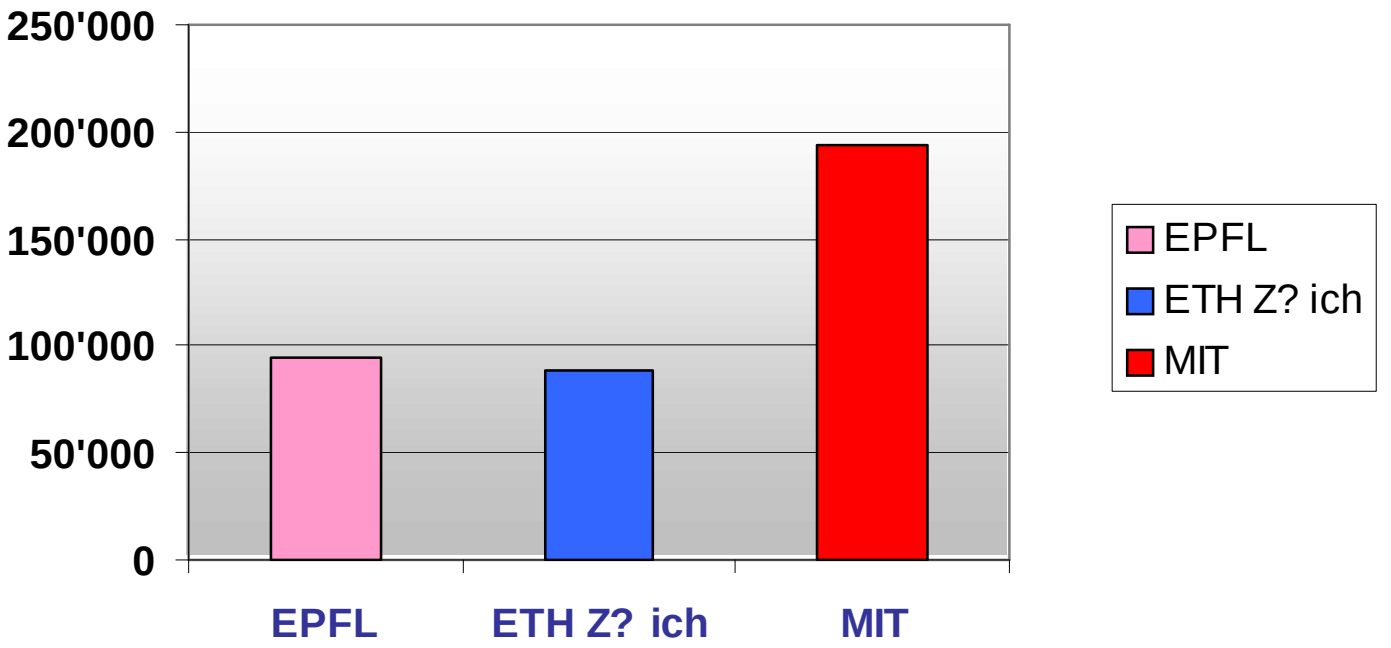


*	
Austria	3
Benelux	4
France	4
UK	4
Italy	1
Japan	1
Scand	2

11.1.02 Bre/lü

Expenditures per Student

CHF **(1 € = 1.6 CHF)**



ETH Zurich:

- Top ranking university in continental Europe

  (Shanghai Jiao Tong University: Academic Ranking of World Universities 2005
  Times Higher Education Supplements: World University Ranking 2005)

- 21 Nobel Laureates

  Examples:
  Chemistry 1939: Leopold Ruzicka
  Physics 1945: Wolfgang Pauli
  Chemistry 1975: Vladimir Prelog
  Chemistry 1991: Richard Ernst
  Chemistry 2002: Kurt Wüthrich

^
Prof. Kurt Wüthrich
<
Prof. Richard Ernst

Pritzker Laureates on the Faculty of ETH

Jacques Herzog and Pierre de Meuron, Pritzker Architecture Prize Laureates, 2001. The Pritzker Prize is seen as the Nobel Prize of Architecture

Sources of Funding

Historically:

The Swiss educational system is publicly funded

Idea:

a democratic society needs well educated and critically thinking citizens.

It is the task of the state to fund the educational system and to supervise it

but to give it the highest possible degree of autonomy and independence.

Sources of founding: Situation today

Elementary and High Schools are public and free of cost. They are fully financed by the regional governments (Cantons)

Regional Universities are mainly financed by their regional governments, but

- Central government subsidizes in a direct and in a indirect (National Science foundation, etc.) way
- Other regional governments pay a fee per student

ETH gets funded directly from central government

The intercantonal agreement

Every Canton (region) has at most one university

If student from canton A goes to study at university of canton B then

Canton A pays canton B a sum that covers roughly half the real cost of the program (10’000 or 23’000 or 46’000 CHF)

For foreign students there is no compensation

ETH gets nothing

Contribution by Federal government

- Between 10 and 35% of the full costs to regional universities, depending on student number and needs.
- About 85% of the full cost to the “ETH – domain” (ETZ Zürich, EPF Lausanne and 4 research institutes)

  ETH-Council distributes amongst the 6 institutions
- Funding Agencies (National Science foundation and others), European Framework Programs

Private contributions

- There are fees for students, but they are minimal (~1000Fr p.a.)
- Contributions by industry less than 10% of the total costs
- Foundations and individuals until recently virtually nothing

New situation

- Number of students drives costs up
  - 1950: 2%,
  - 1980: 10%,
  - 2006: >20%

of a cohort go to university

- international competition and collaboration
- Level cannot be maintained uniformly
- Political side is asking for more control

Budget Development

Federal government proposes yearly increases for the next for years:

Overall	6.0%
- ETH Domain	3.7%
- Cantonal Universities	4.6%
- Universities appl.sci.	7.8%
- National Science Found.	7.5%
- Bilateral collaboration	14.9%
- EU Programs	8.1%

Tendencies and Problems: Indicators

- **So far**: funding based on annual requests, budget proposals, activity plans
- **Now**: performance indicator based

Problem: indicators

- measure quantity, hardly quality
- have strong steering effects
- limit autonomy

Competition through projects

- National science foundation
- European framework programs

- ETH internal: Fund of 25 mio CHF to support interesting, high risk projects
- ETH internal: Fund of 3 mio CHF to support projects for innovative teaching

- **Danger:** more and more earmarked funds for special projects

More funding for the best

Fact: ETH is better funded than most comparable institutions in Europe:

by a factor

- 2 – 3 better than German universities,
- 6 – 8 better than Italian Universities,

but

- compared to MIT it is half as well off

Making distinctions between the institutions

- As long as 2% of a cohort go to university it is affordable to aim for highest level in teaching and in research for all institutions
- Now: qualifications, demands of students differ widely: not everybody needs an education by Nobel laureates and in a place where the most expensive research is being conducted
- All universities have to remain active in research, but not all at the same level

How to determine the Flagships

- Historical facts: respect those who already are flagships
- In the USA: the Carnegie list of the top 100 has changed very little over the past 100 years
- UK is very high up in the world in terms of its competitiveness. But the famous name institutions are still on top

How to determining the Flagships

Japan decided to differentiate funding COE21
(Centre of Excellence in the 21 Century)

Institutions were not to be categorized or ranked, but only research units.

Counting the CEO21 research units the top ten of the institutions are:

- 7 former imperial universities (Tokyo and Kyoto U first)
- the 2 best known private universities (Keio, Waseda)
- top engineering university (Tokyo IT)

The German Initiative for Excellence

3 lines of additional funding:

- New graduate schools
- New research networks
- New visions and concepts for the future development of the university

Have to be successful in the first two to be admitted to the third one

Results so far

3 universities get “Excellence Status”:

Technical Universities Munich and Karlsruhe and LMU, also in Munich

(now under way: second round)

Dispute with political side: uneven geographical distribution

Crucial: Avoid masking political decisions as results of competition and academic qualifications

Conclusion

Too much assessing, evaluating etc.

- diverts a lot of energy, costs a lot
- keeps the researchers and teachers from doing their job
- leads to meaningless institutional efforts to increase the scores, rather than to improve the performance

- And produces little that is different from what was known before

New sources of funding

States alone cannot bear the full burden of HE if level of quality is to be maintained or improved.

But:

Higher Education leads to higher incomes (proven statistically)

Consequence: Students have to bear their share of the cost

Condition: Optimal systems of grants and loans

New sources of founding

Industry profits from well educated collaborators

It has to contribute to HE efforts by

- Supporting projects
- Funding students
- Helping to build up endowments
- Finding new ways of collaboration in teaching and learning

Examples

- UNITECH international

8 leading technical universities, 25 big worldwide acting companies

- Swiss Finance Institute

Some concluding remarks

- Universities need some stability in their funding: time constant is 4 – 5 years
- Competitive funding by project funding is fine but the projects should not be defined top down
- Differentiation in the HE sector is necessary otherwise overall quality will go down
- Political arguments should play a minor role and be clearly marked as such

And after all…..

- A good, fair and efficient educational system is an important condition for prosperity
- Culturally important programs have to be supported, even if they are financially weak

The role of universities in the global innovation system – are we facing a global crisis of competence?

President, Professor Anders Flodström

The Royal Institute of Technology (KTH), Sweden

KCUE Seoul, June 28, 2007

ROYAL INSTITUTE OF TECHNOLOGY

KTH, the Royal Institute of Technology
Excellence in Education, Research and Entrepreneurship

ROYAL INSTITUTE
OF TECHNOLOGY

Professor Anders Flodström, President

ROYAL INSTITUTE OF TECHNOLOGY

- Professor Anders Flodström, the President of the Royal Institute of Technology (KTH) was born in 1944. He graduated from the Faculty of Engineering, Linköping Sweden in 1970 and received his PhD in Physics in 1975. He was appointed Professor of Material Physics at KTH in 1985. He became the President of KTH in 1998.
- He is a former researcher at Xerox PARC and NIST. He has been CEO of the Knowledge Foundation, established by the Swedish Parliament in 1994. He has held the position of Secretary General of the Swedish Research Council for the Engineering Sciences and was previously President of Linköping University

History of Universities

- Innocentius VII (1300), the idea of the European university
- Humboldt (Berlin 1810) the idea of the research university
- Industrial Revolution and Napoleon, start 1750
- Science Revolution, start 1900
- Computer Revolution, start 1950
- Communications Revolution, start 1980
- Dream Revolution, start 2000, Zang Tielin

ROYAL INSTITUTE OF TECHNOLOGY

Trends in society

ROYAL INSTITUTE OF TECHNOLOGY

- The New Economy or the New Product is King!
- New infrastructures; energy, water and ICT
- Globalization
- New regions
- Science and Technology at the centre

Trends in society

ROYAL INSTITUTE OF TECHNOLOGY

- New emerging economies
- 1 billion from poverty to middle class
- China; the global factory
- India; the global IT provider

Science and technology The universities of the future?

ROYAL INSTITUTE OF TECHNOLOGY

- Comprehensive disciplinary
- Comprehensive thematic or multidisciplinary
- New role for engineering in creating economic growth and developing infrastructure for a sustainable society

Trends in research

- The rebirth of the generic disciplines; new ones and old ones
- New " mixed" technology systems, the role of medicine, economics, social sciences and humanities
- Design and dreams
- Demand and curiosity; conflict or synergy
- Lead time between strategic basic research and product development shorter and shorter
- Science or innovation?
- Entrepreneurs

ROYAL INSTITUTE OF TECHNOLOGY

Trends in research

ROYAL INSTITUTE OF TECHNOLOGY

- Meta-centres
- Blue skies and strategic
- Vertical and horizontal integration
- Disciplinary or thematic
- Nobel or products
- Never or tomorrow
- Dr Jekyll and Mr Hyde

Trends in higher education

ROYAL INSTITUTE OF TECHNOLOGY

- 50 % in all OECD countries
- Harmonisation in Europe and globally
- New market for research and higher education services
- Mobility
- Ranking
- Informed students
- Mass education and Ivy League
- New Structure for increased competition for talent

A new mission

ROYAL INSTITUTE OF TECHNOLOGY

- The end of the Humboldt Era
- A new university concept
- IPR, patents, licenses, spin offs; economic growth
- The Good University

Economic growth

ROYAL INSTITUTE OF TECHNOLOGY

- Local, regional, national and global innovation systems have become a cornerstone of industrial development and thus of creating prosperity

Entrepreneurs and innovators

ROYAL INSTITUTE
OF TECHNOLOGY

- Same as in football; players and coaches
- Offence, mid-field and defence
- New spirit among students and faculty

All-integrated business

ROYAL INSTITUTE
OF TECHNOLOGY

- Seed capital and research grants
- Incubators and technology parks
- Mobility between academia and business

Politicians' views

- The best policy is no policy, growth will come and go anyway
- Few examples of sustainability
- Underlying macroeconomics and infrastructure more important: also attracts more voters
- Regional

ROYAL INSTITUTE OF TECHNOLOGY

University governance in a historical perspective

ROYAL INSTITUTE OF TECHNOLOGY

- Create, nurture and disseminate knowledge
- The Tower
- Science as truth
- The market
- Integration between university, society and industry, i.e. the triple helix

University governance in a historical perspective

ROYAL INSTITUTE OF TECHNOLOGY

- Higher education
- Research, few scientists, lifestyle and lifetime achievement
- Quality assurance through personal communication

Alternatives

ROYAL INSTITUTE OF TECHNOLOGY

- Federal or state
- Private; Inc or foundation
- Mix
- Contract or Hierarchy
- Difference between research and higher education
- 60% to 100%

The conflict

ROYAL INSTITUTE OF TECHNOLOGY

- Governments need universities to educate the workforce for the new labour market
- Governments need universities to innovate for new products
- Universities need to build up their new knowledge base using the “peer review” quality mechanism - with no external restrictions

Harmonious society or “Lagom”

ROYAL INSTITUTE OF TECHNOLOGY

- Universities will continue to play the dual role
- Being the tool needed to develop industry and society and being the main actor needed to create the necessary new knowledge
- Being independent enough to safeguard values that are scientifically sound, e.g. promote freedom of thought, equal rights to express opinions, diversity in scientific reasoning and democracy
- Model of governance is of utmost importance in creating the new university paradigm
- To serve and to guide

KTH Campus

ROYAL INSTITUTE
OF TECHNOLOGY

Finnish Council of University Rectors

The Role of Universities in the Finnish Innovation Chain. Cooperation between Industry and Academia.

Rector Krista Varantola (University of Tampere)
Vice-Chair of the Finnish Council of University Rectors

Rationale

- Knowledge creation
- Knowledge transfer
- Knowledge management
- Knowledge economy
- Knowledge society

The structure of the presentation

- Universities and the role of universities in Finland
- The innovation system
  - Contracts and IPR rights
- Problematic issues and challenges

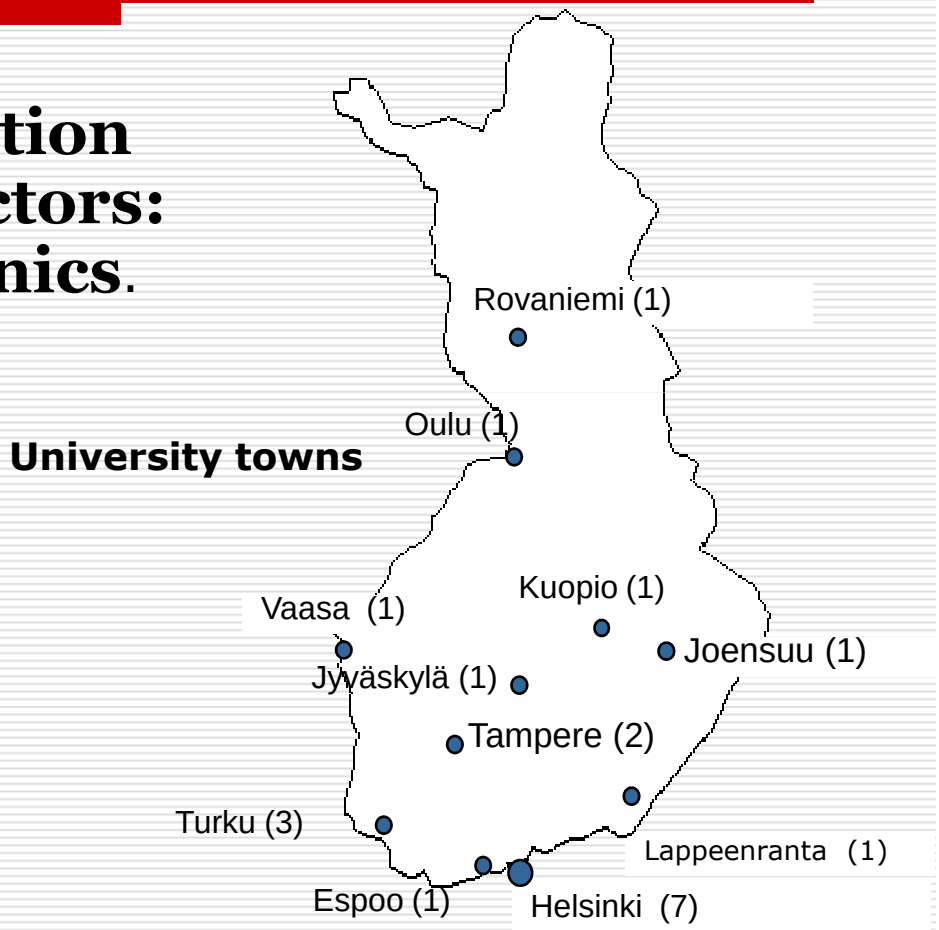
Finland: A Small Country up in the North

- Member of the European Union since 1995
- Population 5,2 million
- R&D funding 3.5% of GDP (2005)
- Exports: 23% high technology

Universities and Higher Education Institutions in Finland

The Finnish higher education system consists of two sectors: universities and polytechnics.

- **21 universities**
- **30 polytechnics**



Universities in Finland

- 10 Multifaculty Universities
- 6 Specialized Universities
- 4 Art Universities
- 1 National Defence College

Universities in Finland

- **Universities have historically played a prominent role in shaping modern Finland**

- **University education is held in high esteem.**
- **HE and research services are available on a regional basis**
- **The cooperation between universities and Finnish industry of growing importance in the global knowledge society**

The significance of university education

- **Equal access to higher education seen as a constitutional right – No tuition fees**
- **Graduate unemployment rate is very low**
- **Education the main means to social advancement**

Universities in Finland
Indicators & Statistics 2006

Students, total 176,599

- **Women 95,066**
- **Men 81,533**
- **Foreign students, total 4,949 (2005)**

Universities in Finland: Indicators & Statistics 2006

- **Number of Degrees gained in 2006: 19,398**
  Women 11,962
  Men 7,436

Bachelor's degrees	3,814
Master's degrees	13,128
Doctorates	1,409
Other Degrees	1,047

Universities in Finland: Indicators & Statistics 2006

- **Personnel**

Teachers	7,883
Research personnel	6,333
Other staff	14,211

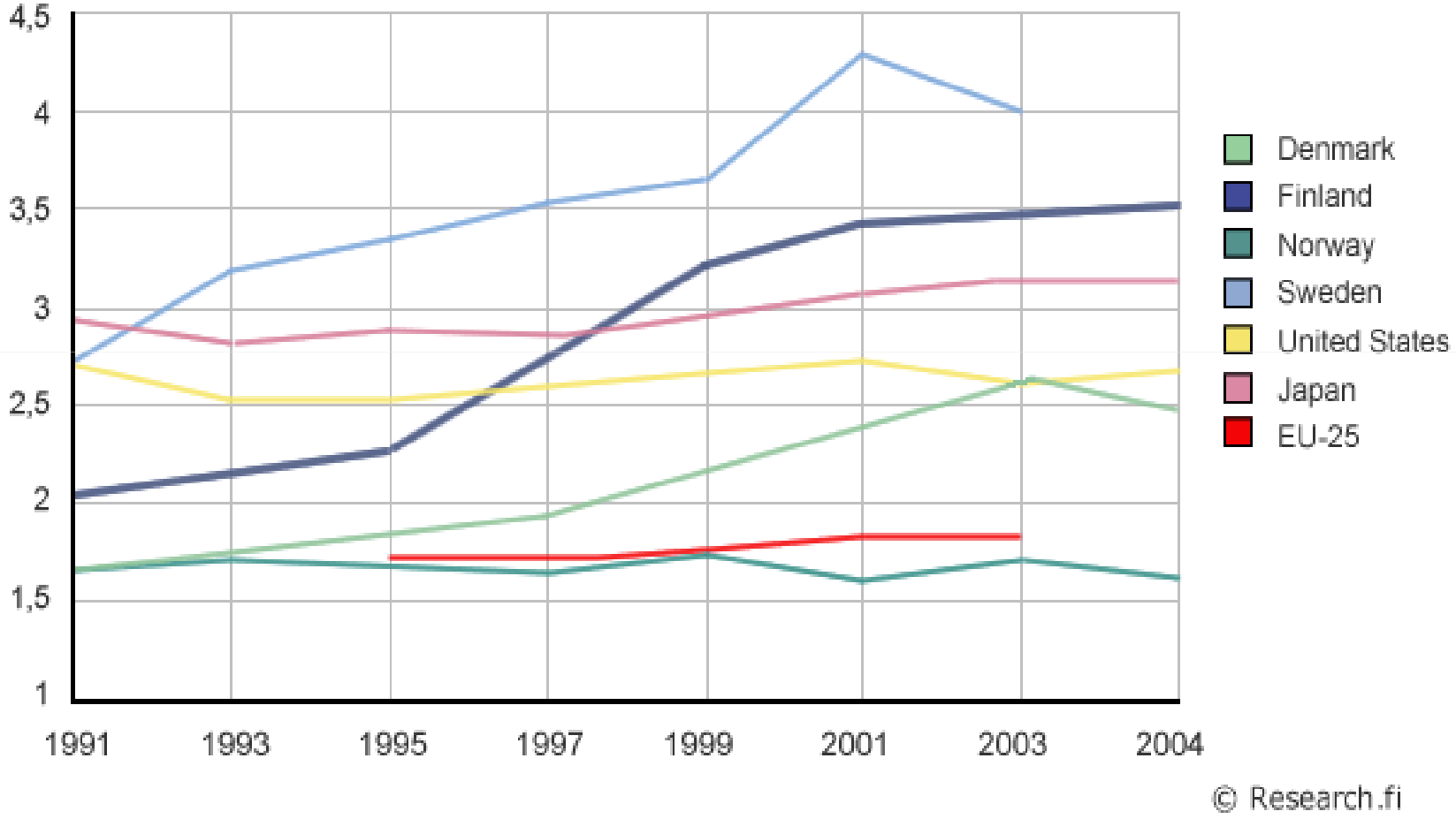
University Funding in Finland

- All universities are public and state owned government agencies, at the moment
- There are no tuition fees for domestic or foreign students, at the moment
- Budget funding decided on in annual results negatiations between universities and the Ministry of Education
- Budget funding is based mainly on targets: numbers of masters' and doctors' degrees, agreed upon on a three-year basis
- Generally speaking, budget funding covers education but most research funding is competitive
- On average, 35 % of total university funding is from outside sources, i.e. competitive research funding from public and private funds

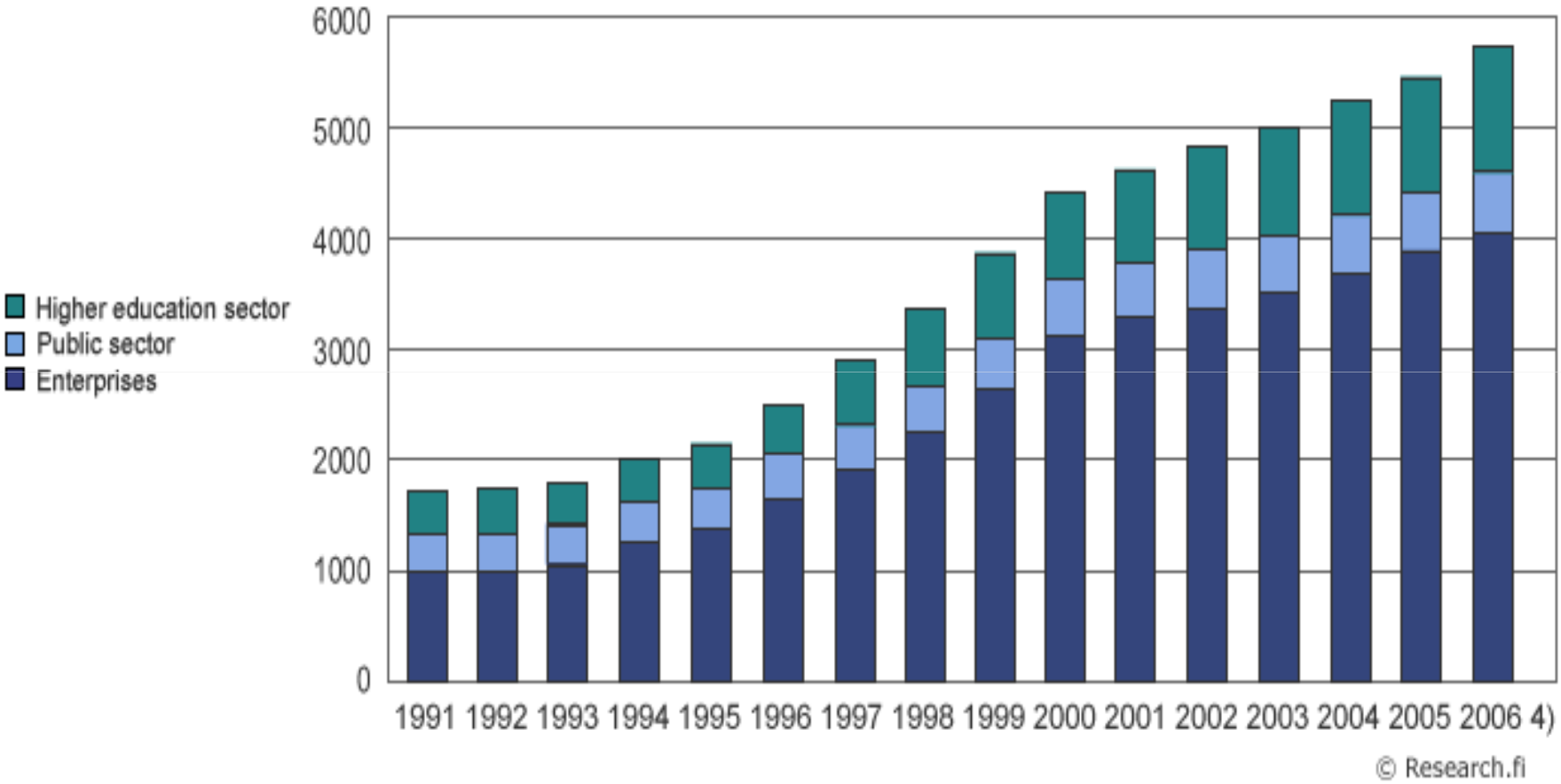
University Funding in Finland

- **Budget funding and building investments EUR 1,317 million in 2006**
- **Supplementary external funding EUR 696 million in 2006**
- **Budget funding, percentage of GDP 0.83 %**
- **R&D funding 3.5% of GDP (2005)**

GDP share of R&D expenditure in some countries



R&D expenditure by sectors (million euros) in 2006



Current Issues in Higher Education and Research (2)

- **Structural development (mergers and coalitions) and financial autonomy**
  - **Proposal I: universities may become a new type of legal person under public law**
  - **Proposal II: Even private, foundation-owned universities possible**
- **Internationalization and global "competitiveness" of Finnish universities**
- **The introduction of tuition fees in international study programmes and for international, non-EU students**

The role of universities in national thinking

- The key formula for success in global knowledge economy
  - Education – Research – Innovation – Global competitiveness

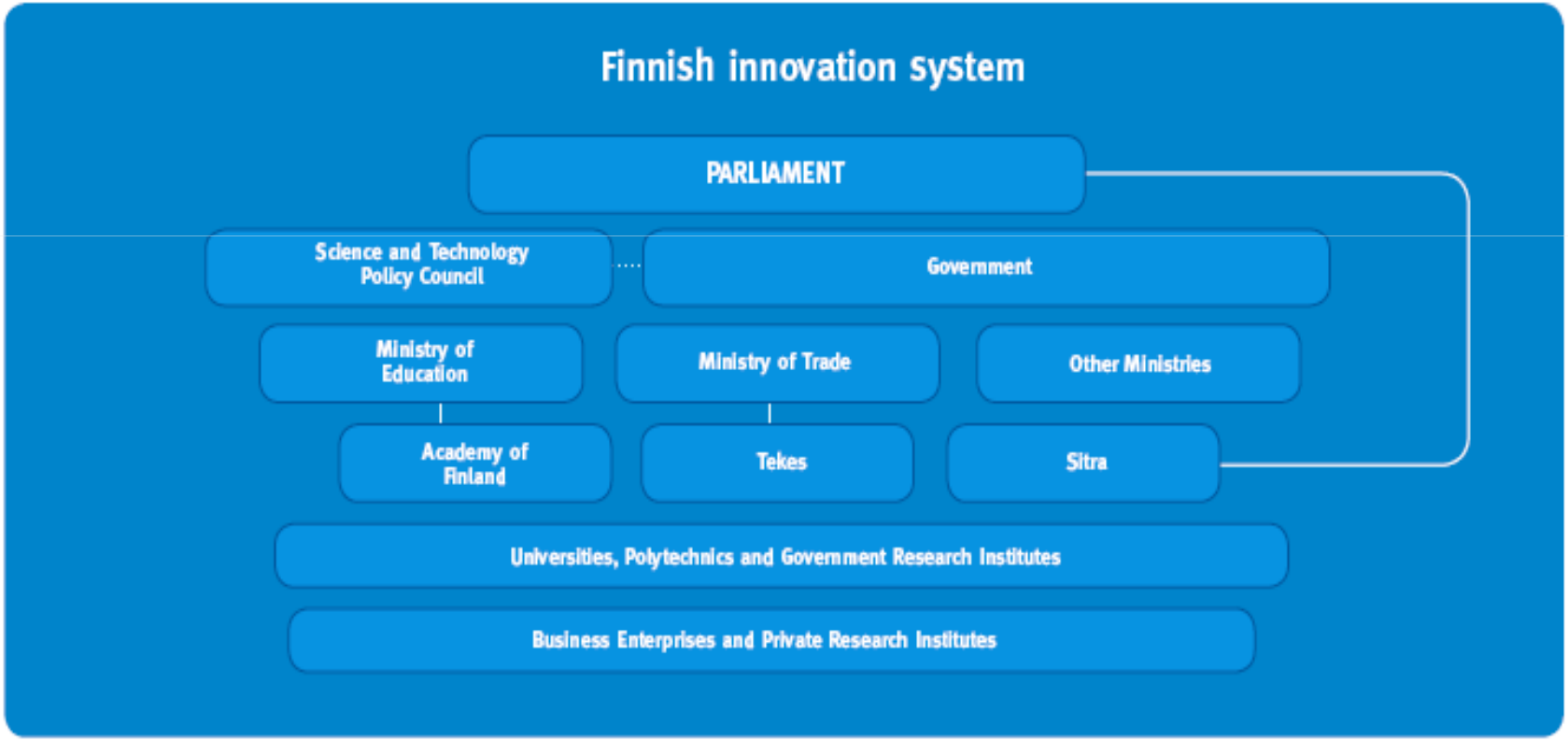
The mission of universities

- Higher education, life-long learning
- High quality research
- The third mission: The impact of universities on societal development (regional, national, international)

The role of universities in the innovation chain

- Triple helix:
- HEIs – Industry- Public Sector Involvement
- Technology transfer
- Means
  - Patents
  - Licensing
  - Spin-off companies

The Finnish Innovation system

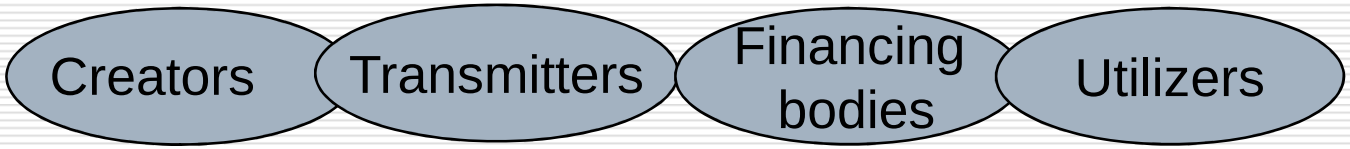


The Science and Technology Policy Council

- The Council is chaired by the Prime Minister. The Council consist of other relevant ministers and representatives from public funding agencies and the industrial and academic sectors. The members are appointed for the four-year parliamentary period

Mechanisms used in Technology Transfer

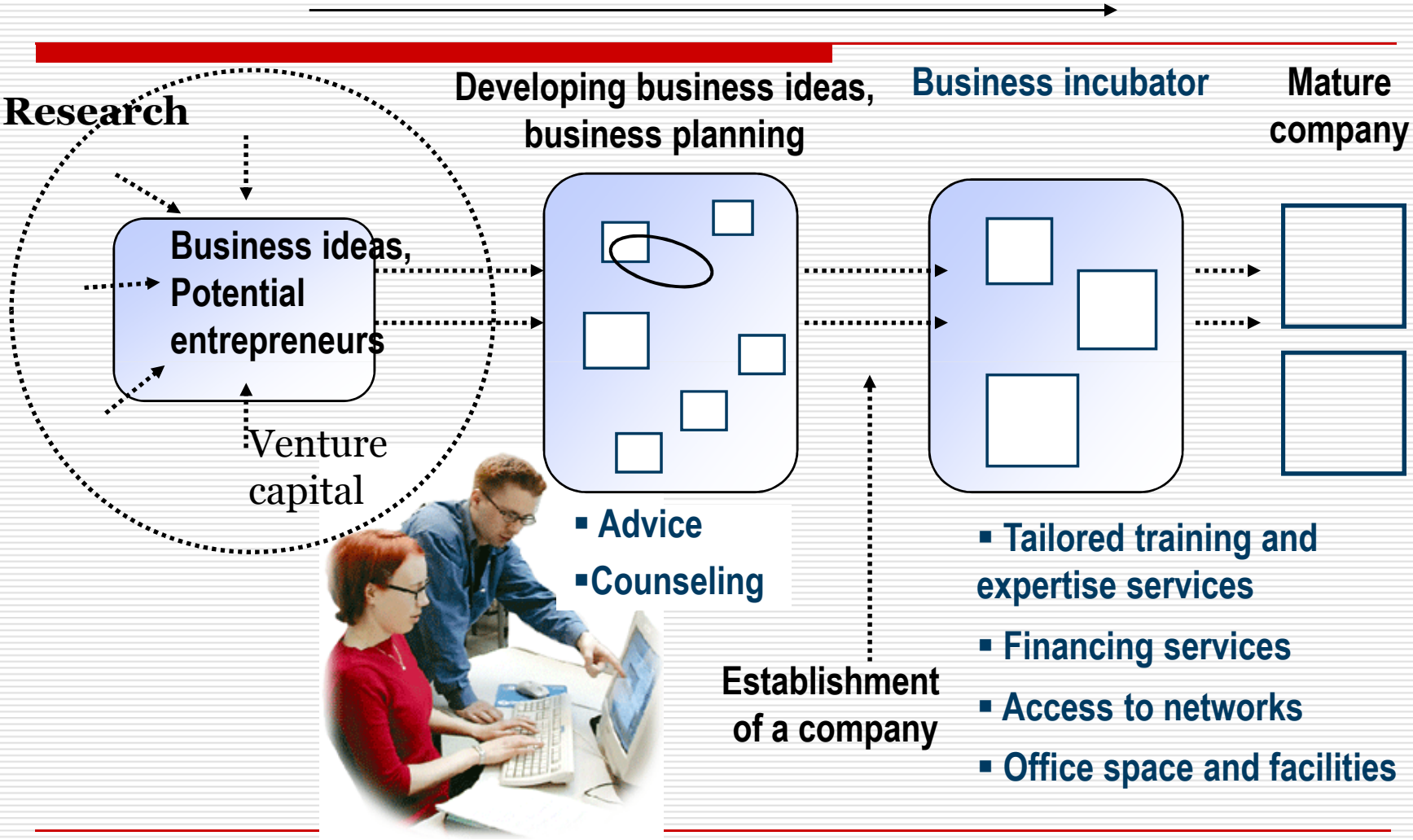
- The Technology Transfer Chain



Universities, Polytechnics	Technology Transfer Organisations	Public or private	Companies or other actors

BUSINESS INCUBATION & ACCELERATION

Training and Development Programmes



Examples of National Networks and Programmes

- Centre of Expertise Programme

- Strategic Centres for Science, Technology and Innovation

Centre of Expertise Programme in Finland

- 13 national clusters selected for 2007-2013
- A special programme that in accordance with Regional Development Act aims to pool local, regional and national resources to utilize high-level expertise
- Concentrates on using the expertise in selected, internationally competitive fields on the development of business activities

Centre of Expertise Programme 2007-2013
Activities

Strategic Centres for Science, Technology and Innovation

- A new programme in its initial phase initiated by the Science and Technology Policy Council
- Aim: The strategic centres will provide a new way of coordinating dispersed research resources to meet targets that are important for Finnish business and society.
- Companies, universities and research institutes will agree on a joint research plan. The plan will aim to meet the application needs for practical application by companies within a 5-10-year period.
- In addition to shareholders, public funding organisations will commit themselves to providing funding for the centres in the long term.

First phase of the programme

- Centres will be established for the following areas:
  - Energy and environment
  - Metal products and mechanical engineering
  - Forest cluster
  - Health and well-being
  - Information and communication industry and services

From knowledge and innovation to products and welfare – the big step!

- **Issues:**
- **How to turn new knowledge and innovations into new companies and products?**
- **How to get concrete results from university- industry cooperation?**
  - Economic prerequisites
  - Legal framework

The Finnish Council of University Rectors (FCUR) recommendations

- In 2007 the FCUR has prepared a number recommendations of rules universities should follow when they enter joint projects with companies.

Rules of the game 1
Recommendations from FCUR

- Recommendations:
- Centralized system within the institution
- Agreements on:
  - Governance and management
  - Responsibilities and legal framework
  - Signatures
  - Upper limits for damage claims
  - Filing damage claims
  - Safety at work
  - Guarantees
- -

Rules of the game 2
Recommendations from FCUR

- Graduate/post-graduate theses are public knowledge
- Definition of background material
- Definition of results material
- Definition of the rights of the commercial partner to the results
- Definition of the ownership and use of results
- IPR payments

Rules of the game 3
Recommendations from FCUR

- Payments always to the University account
- Cost estimates based of full-cost calculations
- The work done as part of regular university work also calculated on full-cost basis
- No non-chargeable work after contract period

What already exists at universities

- Support services for innovation promotion
- A national project for developing innovation services started in 2006
- Work has started on the implementation of the full-cost model
- Discussions in progress about future earnings models

Ministry of Education Measures

- Funding for a joint project on academic research and innovation services
- Work has started on defining the indicators for "societal impact" of university work
- Implementation of the government programme
  - Innovations
  - IPR rights
  - Internationalization

Conclusions

- A great many changes taking place in the operating environment
- A transition period from conflicting interests to complementary cooperation
- The innovation system cannot thrive without substantial investment in basic research done at universities
- The recognition and identification of the aims and roles of the partners in the innovation chain necessary for a win-win situation

We are not there yet
Problems and challenges

- The Science and Technology Policy Council and its 2006 policy report
  - emphasizes the need to step up efforts to utilize and commercialize research results

WHY?

- While the current innovation system has worked well, it no longer meets future challenges in all respects
- R & D and innovation as well as the funding schemes have been mostly directed at fragmented short-term projects
- International exposure has only been managed by a handful of organizations and individual top researchers
- A new approach is needed to strengthen areas of research and technology that are important to Finland and to create new areas of national competence. (Strategic centres)

Social and service innovations

- Social and service innovations are of growing relevance and importance to Finland
- Service sector under-developed in Finland
- Life Is not only technology but are the technology funding agencies aware of this fact?
- Companies offering business and development services are more up-to-date in this respect
- The aging population makes social and service innovations even more important

Universities and the impact of their research results

- Problems:
- Several HEIs in Finland do not have the resources to take care of the management of innovations and IPR issues
- Challenges:
- Systematic inter-university cooperation needed in these matters
- The big markets are outside Finland

Pessimistic comments on commercialization

- The commercialization of innovations is the weakest link in the innovation chain.
- The volume of innovations with commercial potential is in reality very small (at national level, about ten innovations annually)

Conflicting interests
Technology funding agency views:

- **Globalization has a strong effect on national research policies**
- **Globally oriented Finnish companies will seek partners from the international university network. Finnish universities are not competitive enough**
- **Basic research is important but should be practised in relevant fields.**
- **Universities should offer creative and stimulating learning environments**
  - **concentrating on skills that are relevant for working life**
  - **encouraging entrepreneurship**

Conflicting views
University views

- Creativity should be encouraged in all disciplines
- It is not possible to make political decisions about the type of basic research that will be relevant in 15 years' time
- Universities are seen as a continuation of industry. Instead, they shoud be treated as equal partners which have a right to their own agendas
- Education and research go hand in hand at universities. They should not be assessed as research institutions only
- Product development is not the task of universities

Corporisation of NUS
- Enabling NUS in the Changing Global Education Landscape

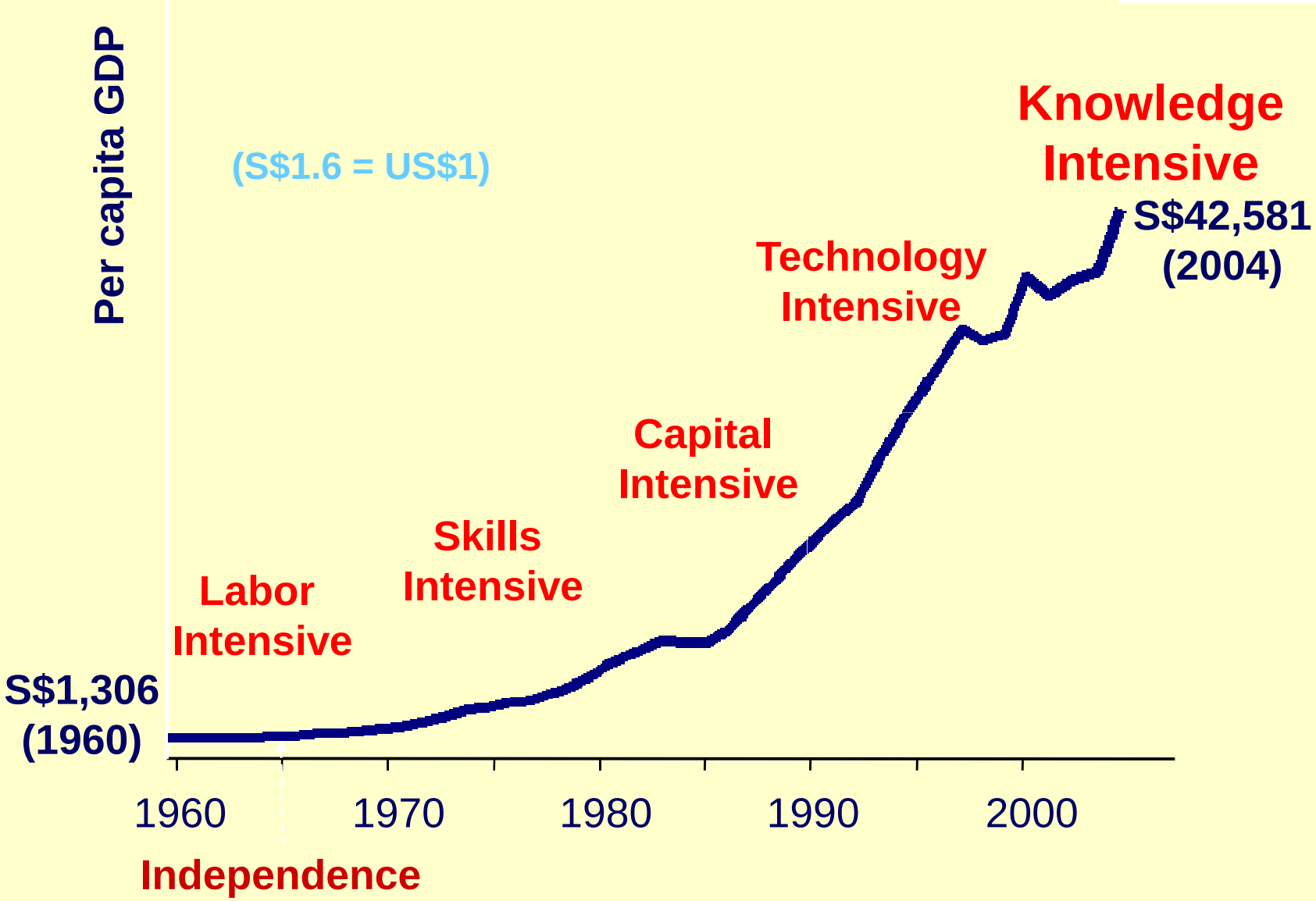
Professor TAN Eng Chye
Deputy President and Provost
National University of Singapore

28 June 2007

Tiny Red Dot with Big Neighbours

NUS National University of Singapore

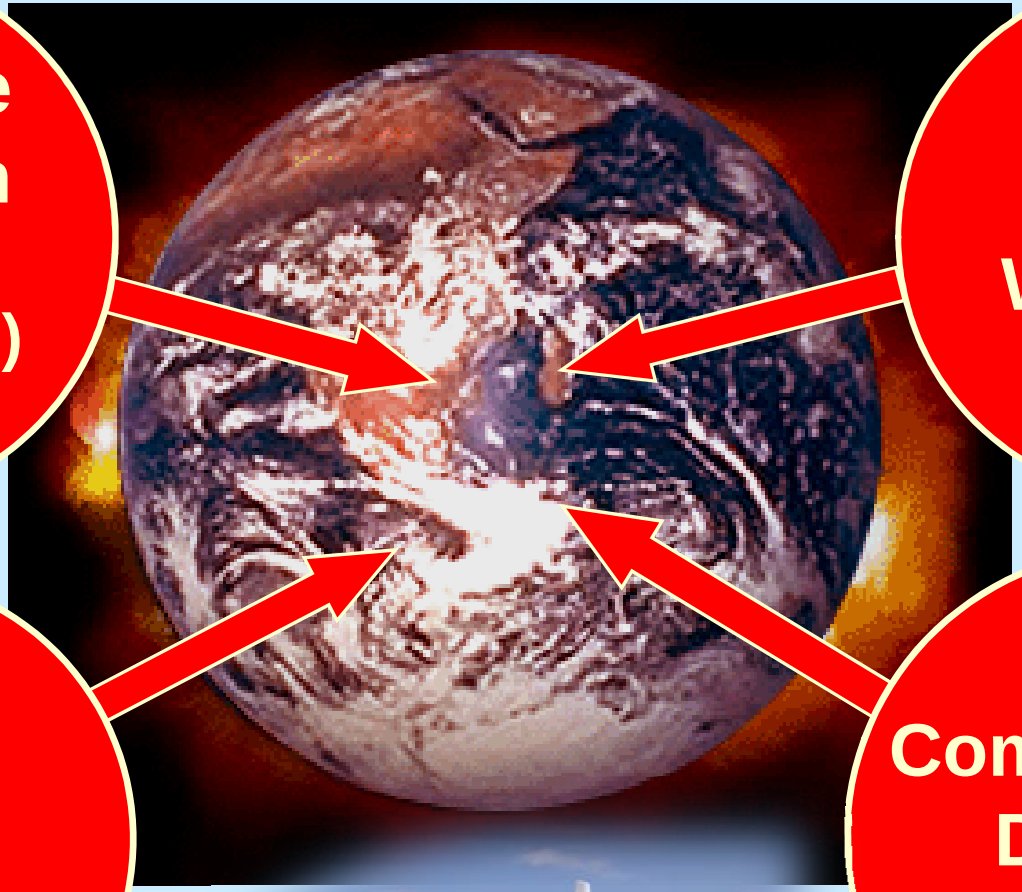
Singapore's Transformation



At the Crossroad

Resource Depletion (Water, Energy, etc)

Global Warming



Air & Water Pollution

Communicable Diseases & Epidemics

Anywhere in the world under a day

Increasing Cultural Complexity

Clash of Cultures?

Ideological & Religious Differences

Social Inequity & Injustice

Global Security & Terrorism

NUS National University of Singapore

Entrepreneurial Economy

Additive Effects

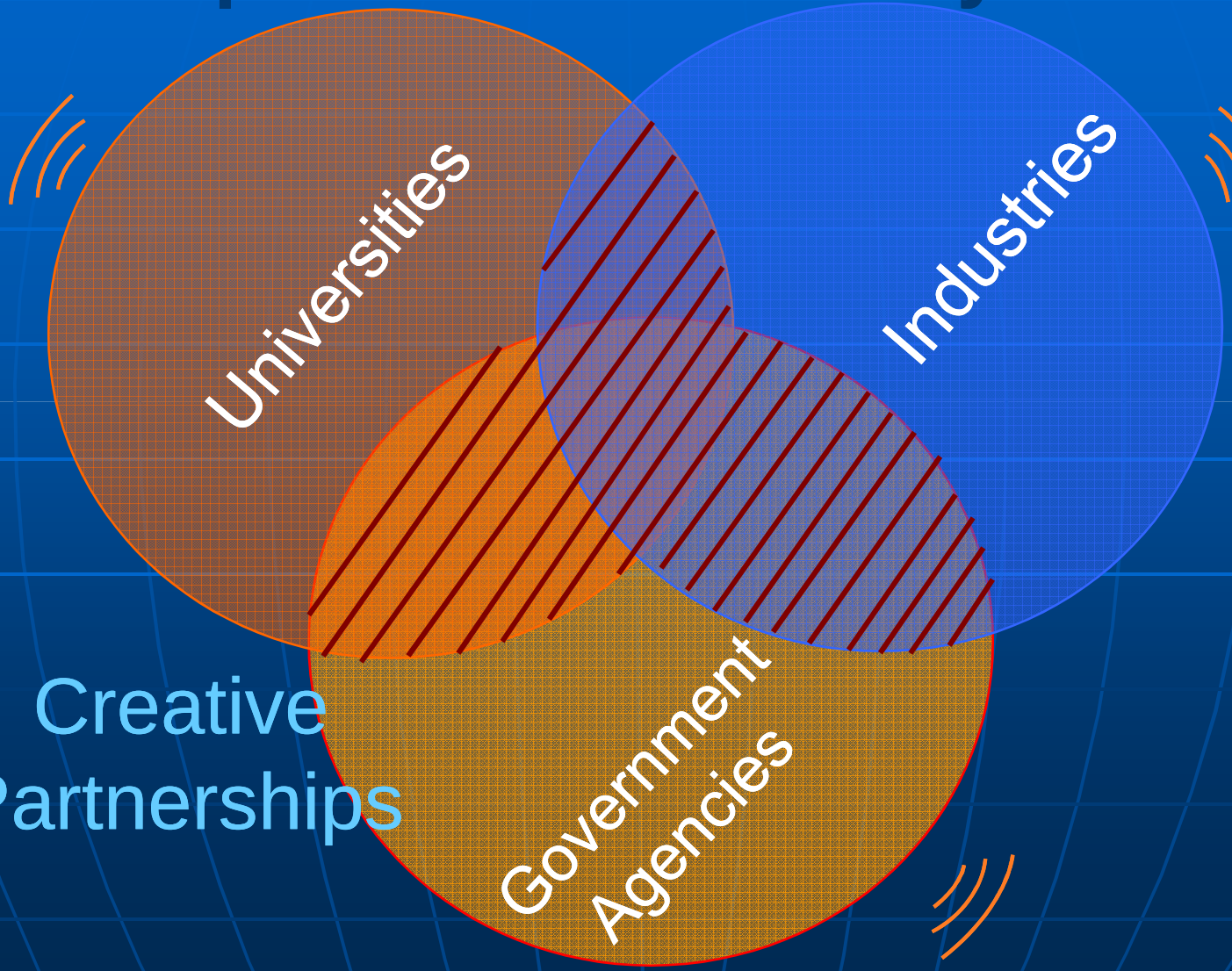
Conscientious workers
Linear addition

Turf conscious groups
canceling one another

Multiplier Effects

Mutual Interests
Complementarity
Intelligent Organization

A Tripartite Relation for an Entrepreneurial Economy



Creative Partnerships

Scaling Up Tertiary Education

- 1980
  - National University of Singapore (**NUS**) is the only university with enrolment about 8,000 undergraduates
- Today – about 25 years later
  - **NUS**, Nanyang Technological University (**NTU**), Singapore Management University (**SMU**) with a combined enrolment of about 40,000 undergraduates and 18,000 graduate students

NUS: A Global University

- **Founded in 1905 as a medical school**
- **Today, a comprehensive public university**
- **150-hectare main campus with teaching hospital, sports complex, cultural centre, staff and student housing; “new” campus at Bukit Timah site; new Graduate Medical School with Duke University**

Background

NUS Facts & Figures

- **13** Faculties / Schools
- **94** Research Institutes/Centres
- **32** University Administration Offices
- **10** on-campus Student Residences
- Total enrolment for AY 2006/2007:
  32,600 students comprising
  23,500 undergraduates and
  9,100 graduate students
- 1,900 teaching faculty and 1,350 research staff

Corporatisation of NUS in Apr 2006 – Principal Considerations

- Greater autonomy to enable universities to differentiate themselves and achieve peaks of excellence
- Greater ownership by all stakeholders: staff, students and alumni
- Accountability & alignment with national objectives

Key Areas

- Governance
- Enhanced Accountability Framework
- Funding: One-Line Block Budget
- Tuition Fee Setting & Financial Assistance

Governance

- Corporatisation of NUS as "**not-for-profit" company limited by guarantee**
  - "Signalling effect" to engender a mindset change
  - No longer constrained by operational regulations imposed on statutory boards
- NUS and Ministry of Education signed **Policy** and **Performance Agreements**
- Promoting sense of community and spirit of ownership
- Performance-based funding approach

NUS Board of Trustees

- From **representational** to **competency-** & **contribution-based** membership
- NUS can decide on size and term of appointment
- No need for identical internal governance structures across universities
- Chairman of the Board appointed by the Ministry of Education

Building Sense of Ownership and Community

- Empower Deans, Department Heads and faculty members
- Engender a culture of ownership and initiative
- Engagement of faculty members in various levels of decision making
- Students and alumni also have a hand in shaping university policies

Enhancing Accountability

- **Policy Agreement** – broad directions on the development of the tertiary sector
- **Performance Agreement** – mutual agreement between university and Ministry of Education on performance parameters
- **Quality Assurance Framework for Universities** – quality audits conducted once in 3 years by local and international panels

Funding:
One-Line Block Budget

- Government provides guidelines on manpower needs - **flexibility** to vary student enrolment in various discipline clusters within 10 to 15% of the guidelines
- Government committed to funding 75% of cost of educating a student (student pays 25% of costs in terms of tuition fees)
  - e.g., current tuition for a Science undergraduate is S$6,100 per year.

Performance-based Funding Approach

- One-line funding based on graduate output
- **Incentive Funding** for new initiatives
- **Research funding** based on quality of research and graduate students
  - Ministry of Education funds research scholarships for good graduate students
  - Ministry of Education is one of the several funding agency for research grants (mostly for blue-sky academic research)
  - Research Centres of Excellence

NUS – a Global University

NUS
National University
of Singapore

NUS Globalisation Strategies

- Forging **global partnerships** to tap into the global learning community
- Providing exposure to NUS students
  - NUS Overseas Colleges
  - Joint Programmes with top universities
  - Target - 20% of all our students to spend a semester overseas (about 1,200 per year)
  - Target – 50% of all our students to spend at least 6 or 8 weeks in a foreign academic institution overseas (about 3,000 per year)
  - Summer Programmes in NUS

Global Alliances

NUS National University of Singapore

APRU World Institute (AWI)

Association of Pacific Rim Universities (APRU)
37 universities, 5 continents

International Alliance of Research Universities
10 research universities, 4 continents

Global Enterprise in Micro-Mechanics and Molecular Medicine
13 research institutions, 3 continents

Building Intellectual Capital

Association of Pacific Rim Universities

Russia
Far Eastern National University

China
Fudan University
Hong Kong University of Science & Technology
Peking University
Tsinghua University
University of Science & Technology of China
Zhejiang University

Chinese Taipei
National Taiwan University

Japan
Keio University
Kyoto University
Osaka University
University of Tokyo
Waseda University

Korea
Seoul National University

Indonesia
University of Indonesia

Malaysia
University of Malaya

Philippines
University of the Philippines

Singapore
National University of Singapore

Thailand
Chulalongkorn University

Australia
Australian National University
University of Sydney

New Zealand
University of Auckland

Canada
University of British Columbia

USA
Stanford
Caltech
UC, Berkeley
UC, Davis
UC, Irvine
UC, Los Angeles
UC, San Diego
UC, Santa Barbara
University of Oregon
University of Southern California
University of Washington

Mexico
National Autonomous University of Mexico

Chile
University of Chile

NUS Globalisation Strategies

- Forging global partnerships to tap into the global learning community
- Providing exposure to NUS students
  - **NUS Overseas Colleges**
  - Joint Programmes with top universities
  - Target - 20% of all our students to spend a semester overseas (about 1,200 per year)
  - Target – 50% of all our students to spend at least 6 or 8 weeks in a foreign academic institution overseas (about 3,000 per year)
  - Summer Programmes in NUS

Innovation and Integration
Building Global Bridges

NUS National University of Singapore

NUS Overseas Colleges

KTH

Stockholm

Stanford
Silicon Valley

Philadelphia

U Penn

Fudan

Shanghai

Bangalore
IISc

24

Bridging Cultures and Continents - Ming Chong

Silicon Valley, 2003 - 4

East Timor, 2004

NUS Globalisation Strategies

- Forging global partnerships to tap into the global learning community
- Providing exposure to NUS students
  - NUS Overseas Colleges
  - **Joint Programmes with top universities**
  - Target - 20% of all our students to spend a semester overseas (about 1,200 per year)
  - Target – 50% of all our students to spend at least 6 or 8 weeks in a foreign academic institution overseas (about 3,000 per year)
  - Summer Programmes in NUS

Recent Examples of Joint Programmes

- NUS Lee Kuan Yew School of Public Policy – **London School of Economics** double degree in MPP and MPA
- NUS-**University of Illinois at Urbana Champaign** Joint Masters and PhD in Engineering
- NUS-**University of North Carolina at Chapel Hill** joint degree in humanities and social sciences
- NUS-**New York University** double Masters in Law
- NUS-**Waseda University** double degree in international liberal studies.
- NUS University Scholars Programme - **Peking University Yuan Pei Programme** joint programme
- NUS University Scholars Programme – **Stanford University** Summer Programme in California and Singapore
- NUS University Scholars Programme – **University of British Columbia** Summer Programme in Vancouver and Singapore
- NUS – **University of Toronto** Summer Programme in Toronta and Singapore

More - Global Partnerships

- Image Processing and Applications Laboratory (IPAL)
  - **– with CNRS, France**
- Temasek Defence Systems Institute (TDSI)
  - **– with US Naval Postgraduate School**
- The Logistics Institute - Asia Pacific (TLIAP)
  - **– with Georgia Institute of Technology**
- Design Technology Institute (DTI)
  - **– with Technical University of Eindhoven**
- German Institute of Science & Technology (GIST)
  - **– with Technical University of Munich**
- Singapore MIT Alliance
  - **– NUS with MIT in 4 flagship projects aimed at training PhDs in critical areas of research**

NUS Globalisation Strategies

- Forging global partnerships to tap into the global learning community
- Providing exposure to NUS students
  - NUS Overseas Colleges
  - Joint Programmes with top universities
  - **Target - 20% of all our students to spend a semester overseas (about 1,200 per year)**
  - **Target – 50% of all our students to spend at least 6 or 8 weeks in a foreign academic institution overseas (about 3,000 per year)**
  - **Summer Programmes in NUS**

Student Exchange Programme

- **SEP students spend 1 or 2 semesters at an overseas partner university for exposure to different education systems, way of life and culture.**
- **Target of 20% of NUS undergrads on international exchange (about 1,200 students per year)**
- **Participation rate of 17%in AY2006/2007**
- **1,600 reciprocal exchange places at 220 university-wide partners in 40 countries.**
- **Scholarships & Awards for Exchange:**

  Sponsored by university budget, local and overseas government agencies, university partners, multinational companies or philanthropic foundations

- **Language Preparation Programmes:**

  Conducted by NUS Centre for Language Studies

- **Number of Students in AY2006/07: 945 outgoing / 1086 incoming**

Stepping Up on R&D

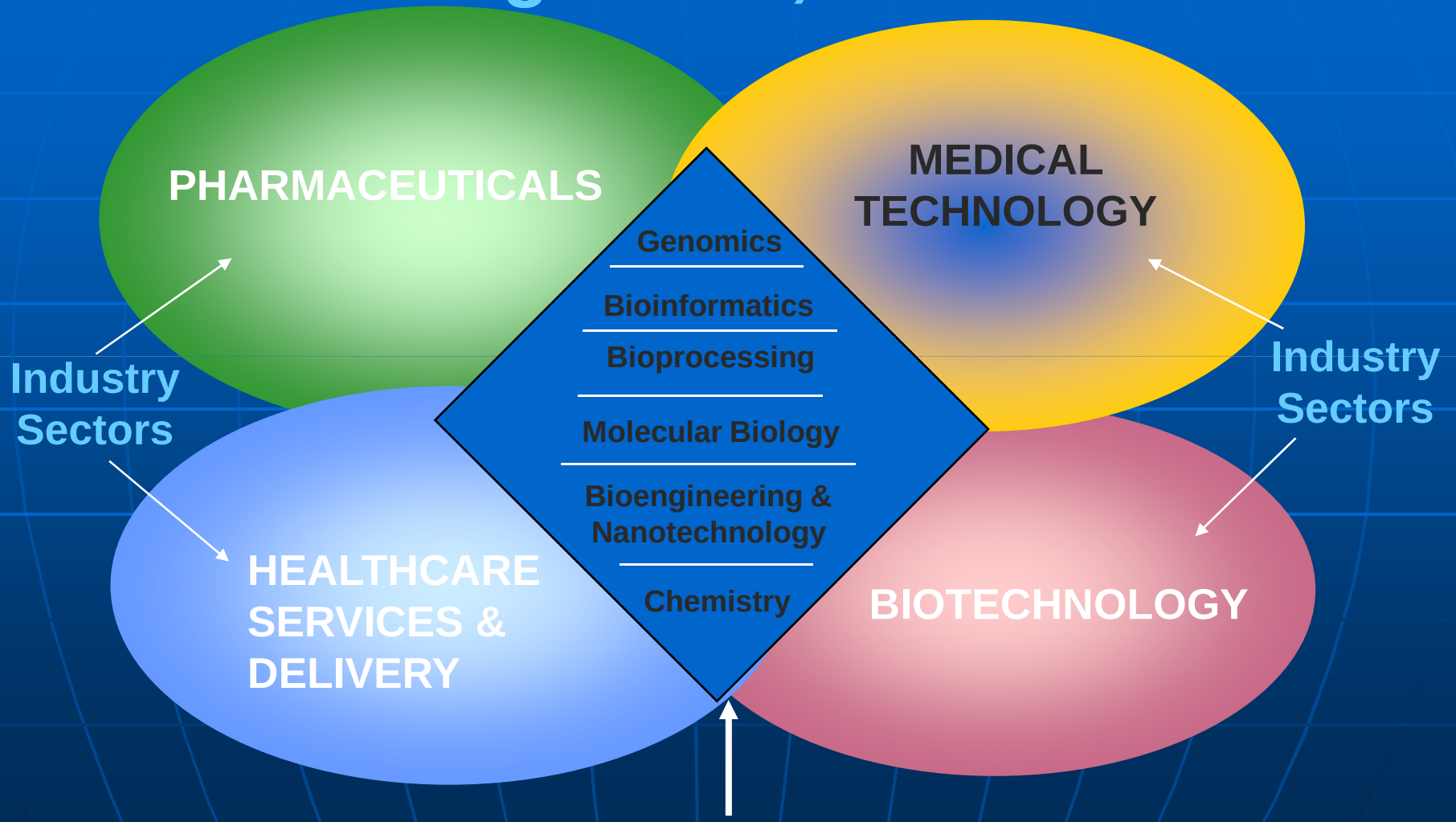
- Position Singapore as a Research and Innovation Hub in Asia
- Agency of Science, Technology and Research (A*STAR) and National Research Foundation (NRF), each with budgets of roughly S$1 billion per year
- Groom NUS and NTU as world-class research universities – build **peaks of excellence**

Strategic Initiatives

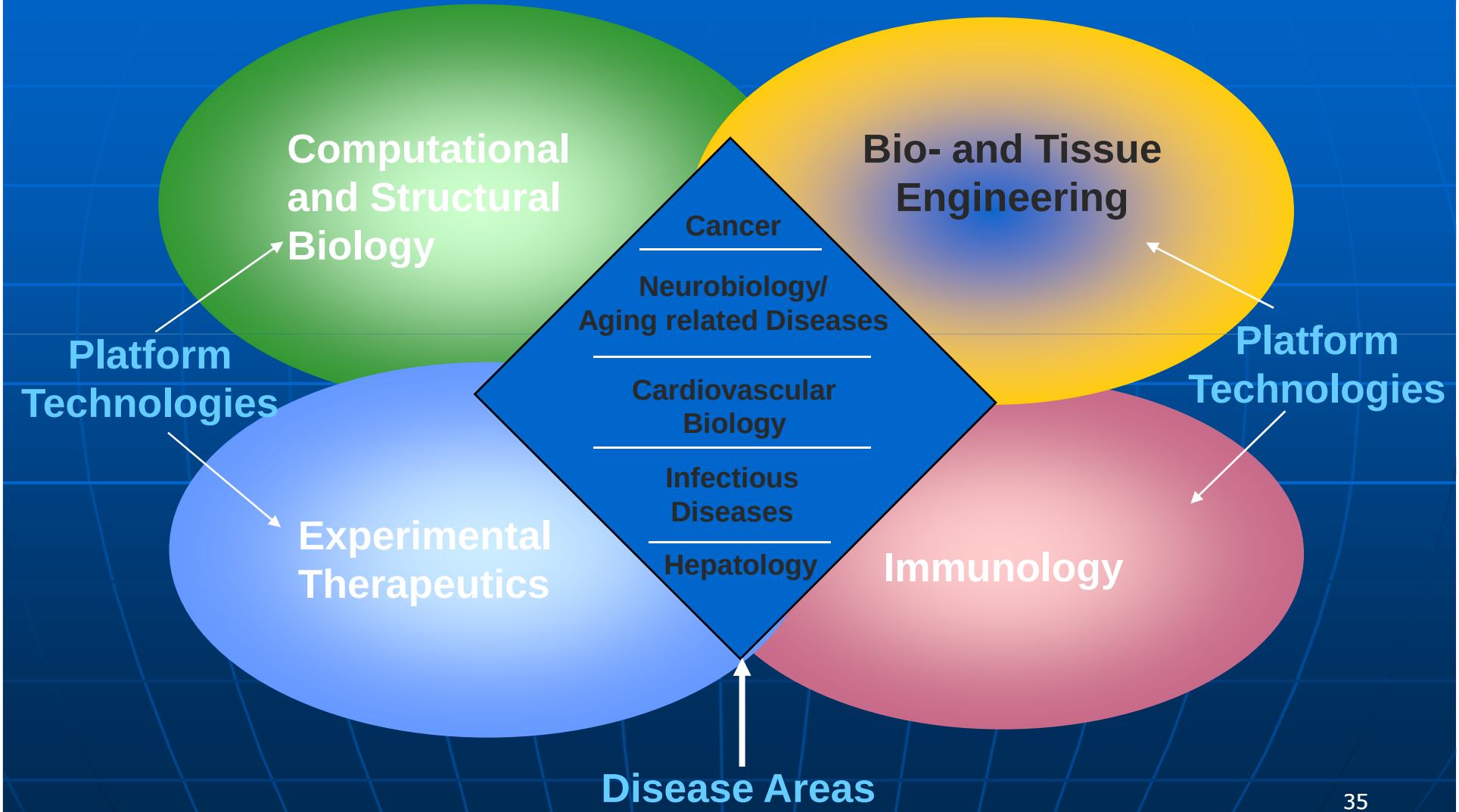
- Corporatisation provides flexibility for NUS to allocate its funds to seed strategic initiatives
- Part of these funds comes from investment returns from our endowment funds (about S$2 billion)
- University funds to grow niche educational and research areas
  - E.g. a strengthened focus on **biomedical sciences**
  - E.g. positioning NUS to win more RCEs
  - E.g. NUS University Town

1 Chromos
2 Centros - Bioprocessing Technology Centre (BTC)
3 Matrix - Bioinformatics Institute (BII)
4 Genome - Genome Institute of Singapore (GIS)
5 Proteos - Institute of Molecular and Cell Biology (IMCB)
6 Nanos - Institute of Bioengineering and Nanotechnology (IBN)
7 Helios

Biomedical Sciences Cluster: Government Agencies, A*STAR



NUS Biomedical Sciences Cluster



Building Intellectual Capital
Partnerships in the Life Sciences

Strategic Initiatives

- Corporatisation provides flexibility for NUS to allocate its funds to seed growing research areas
  - E.g. a strengthened focus on biomedical sciences
  - E.g. positioning NUS to win more **Research Centres of Excellence** and flagship projects from the NRF

Research Centres of Excellence (RCE)

- Be based at either NUS or NTU
- Headed by eminent scientific leaders
- Conduct investigator-led research with global impact
- NUS won the first RCE led by **Professor Artur Ekert** in the area of **quantum information and technology**, with a 5-year grant of more than **S$150 million**.
- NUS places its own strategic funds to grow more RCEs in cancer research, nanoscience, etc.

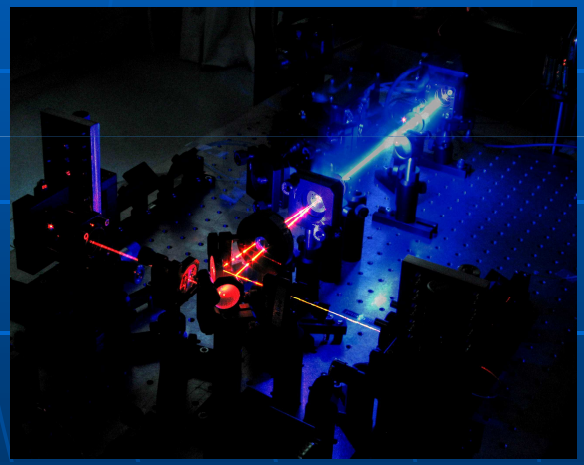
Quantum Information – Today in Singapore

NUS National University of Singapore

We have this

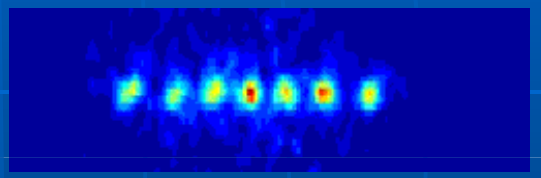
We need this

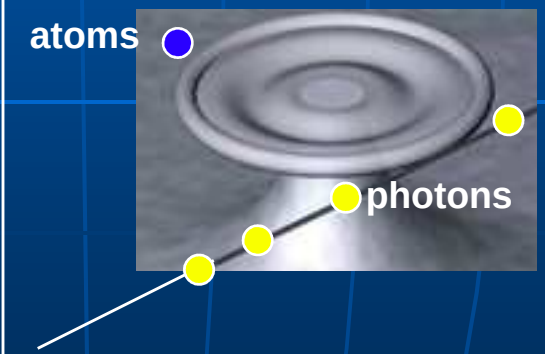
photons



Quantum Communication

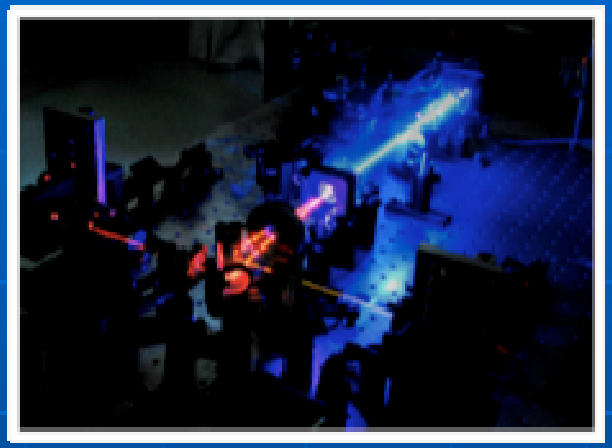
trapped atoms / ions





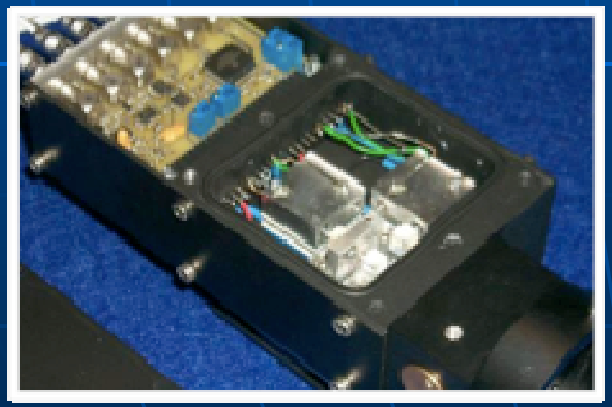
Quantum memories and processors

NUS Strengths in Quantum Information



One of the world's strongest sources of entangled photons

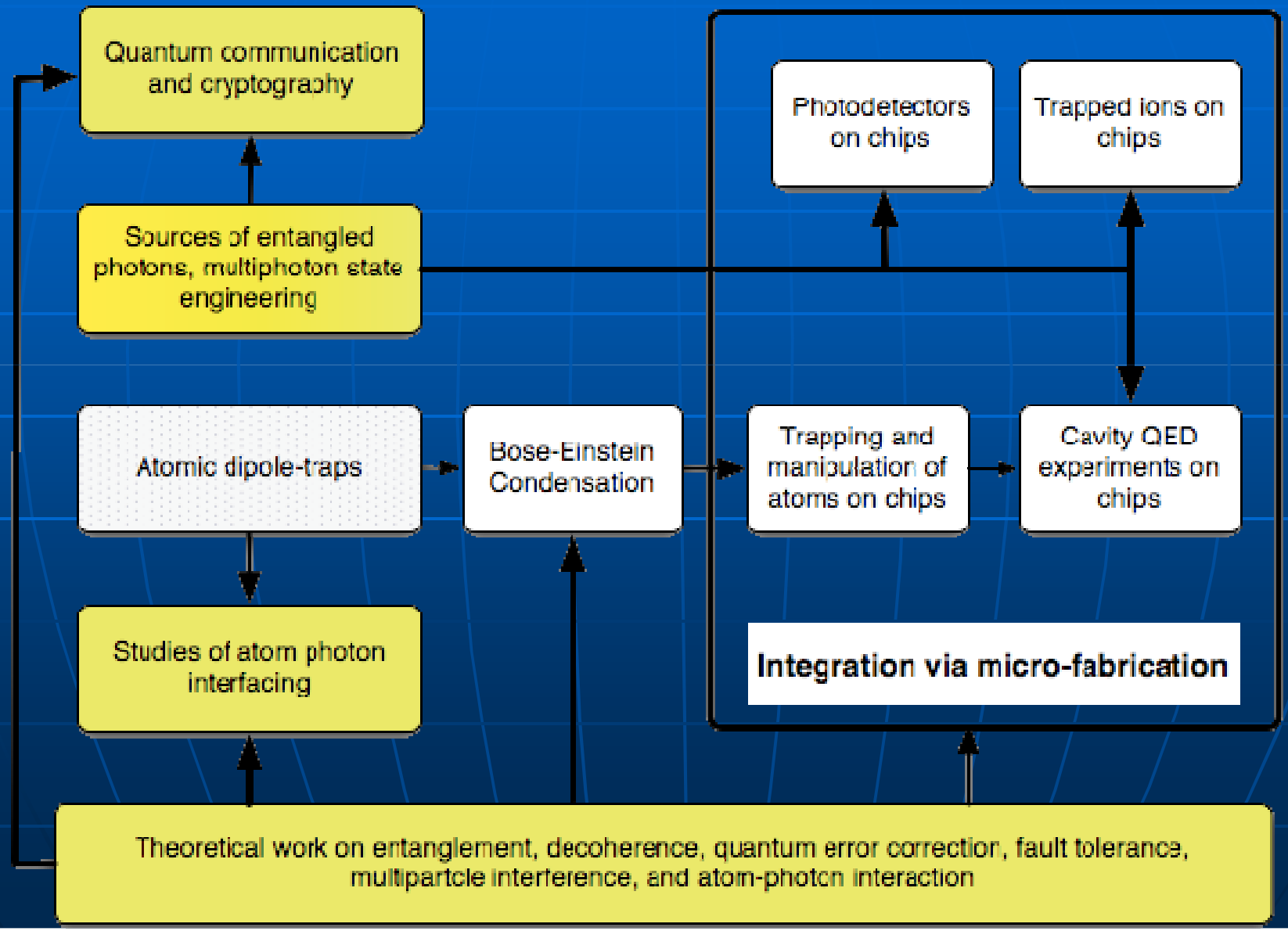
Expertise in quantum communication andcryptography



Home made efficient, robust and portable photo-detectors

IMRE microfabrication facilities

NUS Plan


Quantum communication and cryptography
Sources of entangled photons, multiphoton state engineering
Atomic dipole-traps
Bose-Einstein Condensation
Studies of atom photon interfacing
Photodetectors on chips
Trapped ions on chips
Trapping and manipulation of atoms on chips
Cavity QED experiments on chips
Integration via micro-fabrication
Theoretical work on entanglement, decoherence, quantum error correction, fault tolerance, multipartcle interference, and atom-photcn interaction

NUS Team for Quantum Information

National University of Singapore

Artur Ekert

NUS University Town

- Ambitious project to build **up to 10 Residential Colleges** on a 20 hectare piece of land, next to the main campus
- Each Residential College will house about **600 students**, and will be led by a Master
- Each Residential College will have its own **unique theme**, and will be a platform to integrate **learning and living**
- For example, there will be a "Green" College which will be a zero or minimum energy/emission building, and which would have environment issues as its theme

NUS University Town

- To be ready by July 2010
- Costs more than **$500 million**
- Partial funding by government, by donations and by university budget
- Corporatization allows NUS to consider floating a bond in the financial market to fund this initiative

NUS University Town

NUS
National University of Singapore

NUS MISSION AND VISION

**Advance knowledge and foster innovation,
educate students and nurture talent,
in service of country and society.**

Corporatisation of NUS

- **Enabler** to allow NUS to achieve eminence
- Greater autonomy to enable NUS to **differentiate ourselves**
- Greater **ownership** by all stakeholders: staff, students and alumni

THANK YOU