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Health Innovation as Investment: Biomedical Industry in Singapore

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Health Innovation as Investment: Biomedical Industry in Singapore

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Overview

- **Introduction**
- **Trends in the health sector in Asia**
- **Growth of the biomedical industry**
- **Case study of health investment – biomedical industry in Singapore**
- **Policy issues for health innovations as investment**

Healthcare Consumption versus Investment in Economic Growth

- **Investments in public health yield returns in improved productivity, contributing to GNP growth**
- **Economic development leads to higher heath status and healthcare spending**
- **Excessive consumption of high-cost medical technologies and services at marginal or negative returns is inefficient**
- **? Economic value of medical innovations**
- **? Social costs versus economic benefits**

The Biomedical Industry in Asia: Current Trends and Issues

- High level of private provision and financing
- Increasing privatization and deregulation
- Lack of legal and regulatory framework
- Weak enforcement of laws and regulations
- Infringement of copyrights and intellectual property rights
- Poor quality and potential safety risks
- ? Impact of liberalization and globalization

Healthcare Market Size in Asia

- Total healthcare expenditure in developing regions - US$539 billion world-wide (2004)
- Healthcare expenditure projected at annual growth rate of 9% in developing countries (2000-2004)
- Healthcare expenditure for Asia-Pacific nations (excl Japan, Australia, New Zealand)- US$207 billion
  - China accounts for largest health expenditure (US$82 billion)
  - Out-patient care will account for fastest growth
  - Hospital care continues to be largest share of expenditure

The Freedonia Group (April 2001)

GATS Commitments by Asian Trading Partners in Health Services

- INDIA
- MALAYSIA
- SINGAPORE

A minority of 134 WTO members have negotiated and made commitments in health sector services under the General Agreement on Trade in Services (GATS)

Source: U.S. International Trade Commission.General Agreement on Trade in Services: examination of the schedules of commitments submitted

Factors for Investments in the Biomedical Industry

- **Skilled labour and relative costs**
- **Quality assurance**
- **Intellectual property protection**
- **Regulatory framework**
  - **efficiency of political/legal system**
  - **fair and transparent rules**
  - **clear guidelines and procedures**

Low transaction costs, and not only tax incentives/subsidies

Comparative R&D Indicators

Table 2: *Some Indicators of Performance in Research and Development: India, China and Other Selected Countries*

	India	China	Singapore	United States
R&D Expenditure, billions of dollars, 2002	3.7*	15.6	1.9	276.2
R&D as % share of GDP, 1997-2002	0.8	1.2	2.2	2.7
Researchers in R&D, per million people, 1990-2003	120	633	4352	4526
High technology exports as a % share of manufactured exports, 2003	5	27	59	31
Patents granted to residents, per million people, 2002	0	5	58	302

Notes: *2001 data
Sources: UNDP (2005), Table 13, pp. 262-65 and Table 16, pp. 274-77; UNCTAD (2005), p.105

Case Study of Biomedical Industry in Singapore: Integrated Policies

- **Strong government support**
  - **infrastructure development**
  - **funding for biomedical research**
  - **tax and financial incentives**
- **Sound regulatory framework**
  - **protection of intellectual property**
  - **quality assurance**

Pillars of Economic Growth in Singapore

- **Trade**
- **Tourism**
- **Financial Services**
- **Manufacturing**

New industries

- **Electronics**
- **Information technology**
- **Chemicals**
- **Life sciences**

SingaporeMedicine – Promoted by the Singapore Tourism Board

Economic Review Committee (ERC) 2003 – recommendation targets of the Health Services Working Group

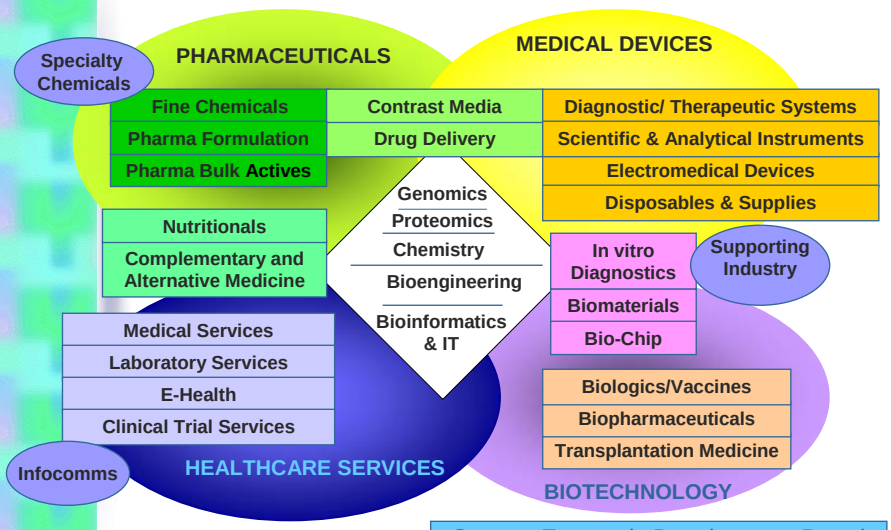
Aims:

- **Attract 1 million foreign patients with I,000 admissions by 2012**
- **Grow market share from 1% - 3% of GNP**
- **Generate $3 billion in health expenditure or $2.6 billion value-added to economy**
- **Create 13, 000 new jobs**

Vision of the Singapore Economic Development Board

To become a Global Medical Hub providing a comprehensive range of world-class value-added Medical Services

Biomedical Sciences Cluster



Source: Economic Development Board

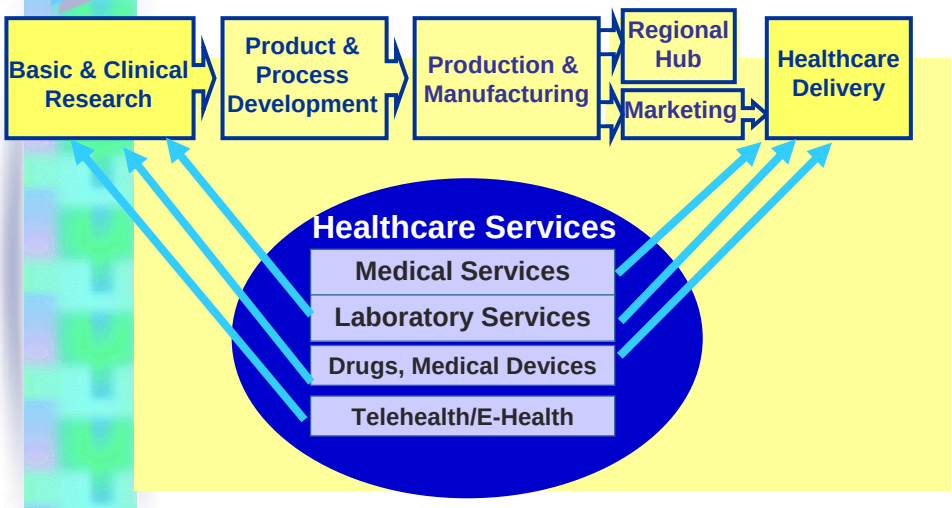
Comparative R&D Indicators

Table 1: *Major Industries Ranked in Descending Order of Their Shares in Total Industrial R&D Expenditure of the Country, India and China*

	India, 1998-99		China, 2004	
Rank	Industries	Share in total R&D expenditure %	Industries	Share in total R&D expenditure %
1	Biotechnology	20.6	Electronics and communication equipment	64.5
2	Pharmaceuticals	15.0	Electronic computers and office equipments	13.6
3	Defence industries	8.7	Medical and pharmaceutical products	9.6
4	Electrical and electronic equipment	7.9	Aviation and aircraft manufacturing	8.6
5	Chemicals	7.7	Medical instruments	3.6
	Total industrial sector	100	Total industrial sector	100

Notes: Indian Statistics refer to R&D expenditure incurred by industrial sector. Chinese statistics refer to R&D expenditure of large-scale and medium-scale industrial enterprises in high-tech industry.
Sources: GOI (2002), Table 5.3, p. 31 and National Bureau of Statistics of China (2005), Table 21-40, p.718.

Value Chain of Healthcare Services



Source: Economic Development Board

Biomedical Industry Promotion by the Economic Development Board

- In 2002, pharmaceuticals contributed $8 billion, or 82% of total industry's manufacturing output, while employment enjoyed a growth of 31% . Medical technology contributed 14% growth in manufacturing output to reach $1.8 billion.
- By year 2010, EDB aims for Singapore to be key business base for 15 world-class companies, and a regional centre for clinical trials and drug development. EDB will invest in R&D and HRD, and nurture start-up companies through co-investments and venture capital.
- The current $11 billion biomedical industry will grow to $20 billion, employing 10,000 in 2010.

Recent Investments in the Biomedical Industry in Singapore

Total venture capital $10.2 billion raised (1983-2000)

- **$1 billion Biomedical Sciences Investments Fund (2000)**
- **Government venture capital fund – $20 million for research & development**
- **Wyeth-Ayerst plans US$300M plants (1999)**
- **Schering-Plough plans US$200M API plant and US$24M R&D Centre, US$100M biotech plant (1999)**
- **Pfizer plans US$350M API plant (2000)**
- **Eli Lilly's Singapore System Biology Centre (2001)**
- **Pfizer's ward at Singapore General Hospital for Phase I Clinical trials (2003)**
- **Biopolis R&D complex (2004)**
- **Duke-NUS Graduate Medical School (2007)**

Recent Government Initiatives for Biomedical Development

- **Ministerial Committee for Biomedical Sciences Industry chaired by Deputy Prime Minister**
- **International Advisory Council**
- **$1 billion Biomedical Sciences Investment Fund**
- **Biomedical Research Council to oversee R&D activities**
- **Bioethics Advisory Committee**
- **National Science & Technology Board restructured into Agency for Science, Technology & Research (A*STAR)**
- **Bio*One Capital – new biomedical sciences capital investment division of Economic Development Board**

Completed Investments in the Pharmaceutical Industry in Singapore

- 1971 Smith Kline Beecham US$118M API plant
- 1979 Glaxo Wellcome US $147M API plant
- 1990 Glaxo Wellcome US$153M API plant
- 1993 Rhone-Poulenc Rover US$59M API plant
- 1995 Glaxo Wellcome US$47M NPMD pilot plant
- 1996 Schering-Plough US$118M API plant and US$100M manufacturing plant
- 1998 Rhone-Poulenc Rover US$41M API plant
- 1999 Schering-Plough US$18M formulation facility
  Aventis (formerly RPR) US35M API plant
- 2001 Merck US$400M plant
- 2003 Merck expanded US$100M plant
- 2003 Pfizer US$350M API plant

(API- Active Product Ingredient)

Biomedical Training and Research Institutes in Singapore

- 1987 – Institute of Molecular & Cellular Biology
- 1990 – Bioprocessing Technology Centre (BTC)
- 1993 – Centre for National Products Research
- 1996 – Bioinformatics Centre
  – Lilly-NUS Centre for Clinical Pharmacology
- 1998 – Centre for Drug Evaluation
- – Kent Ridge Digital Labs
- 2000 – Johns Hopkins-NUH Centre
  – Singapore Genomes Program (SGP)
- 2001 – SGP renamed Genomes Institute of Singapore
- 2003 – BioPolis - biomedical research hub
  – Novartis Institute for Tropical Diseases
- 2007 – Duke-NUS Graduate Medical School

Biomedical/Life Sciences in the National University of Singapore

- $30 million Office of Life Sciences
- Main biomedical thrust on basic mechanisms of human diseases - prevention and treatment
- Main activities – 1) education 2) research 3) training & recruitment
- New life sciences curriculum jointly launched by faculties of science and medicine in 2002
- Linkages with other institutes and centres

Biomedical/Life Sciences Research in National University of Singapore

- Coordinated research involving faculties of medicine, science, engineering and computing; also law, arts & social sciences and business for ethical, legal, social and economic implications
- 5 target diseases
  – cancer, ageing/neurobiology, cardio-vascular, liver and infectious diseases
- 5 platform technologies
  – bioinformatics, bioengineering, experimental therapeutics, immunology and structural biology (genomics, proteomics, etc)
- $100 for redevelopment of medical school
  - renamed the Yong Loo Lin School of Medicine

Some Policy Issues in Development of the Biomedical Industry

- Ethical, legal and social issues of innovations and new technology
- Clinical evidence of efficacy, safety and effectiveness
- Economic aspects - costs & financing, cost-efficiency and cost-effectiveness
- Management of biomedical innovations - production, distribution, quality control and business development

Policy Issues – Role of Government in Health Innovation as Investment

Balancing EQUITY and EFFICIENCY

- **Provision**
  - **Public versus private goods**
- **Financing**
  - **Social protection and affordability**
- **Regulation**
  - **Quality and safety**
- **Information**
  - **Choices and preferences**

Conclusions

- The life sciences era offers much potential for the health and economic development
- Healthcare can be a source of consumption or potential investment in economic growth
- Social costs to be weighed against economic benefits of developing the biomedical industry
- Evidence-based policy research and evaluation required to support biomedical innovations
- Balanced roles of government and market in the public-private mix of health care provision, financing, regulation and information/education
- Need for more comparative systems and policy research for biomedical innovations in Asia

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