PARLIAMENT
OF THE REPUBLIC OF SOUTH AFRICA

RESEARCH UNIT
PC
Te
www.parliament.gov.za

14 September 2011

PORTFOLIO COMMITTEE ON SCIENCE AND TECHNOLOGY INTERNATIONAL STUDY TOUR OPTIONS

1. Introduction

The Portfolio Committee on Science and Technology (PC on S&T), as part of and to enhance its oversight function, wish to conduct an international study tour to one of the following countries; namely, Australia, Brazil, China, Japan, Malaysia, Singapore or South Korea.

The PC on S&T wished to have science and technology information on each of the seven countries to identify possible areas of interest. This brief, therefore, aims to assist the PC on S&T to select a country or formulate a shortlist of countries for its international study tour. The information for each country includes a general country description, the national entity responsible for science and technology, the prevailing science, technology and innovation (STI) policy and priority research and development (R&D) areas, and the current areas of co-operation[1] with South Africa. To conclude the brief, a selection of STI indicators and components of the Global Competitiveness Index (GCI), are presented in tabular format.

2. Country Information

2.1 Commonwealth of Australia

Australia is the world's smallest continent, but sixth-largest country. It has a population of approximately 21.7 million, 89 per cent of whom live in urbanised areas. Australia comprises two territories and six states. The capital city is Canberra. Australia's abundant and diverse natural resources attract high levels of foreign investment and include extensive reserves of coal, iron ore, copper, gold, natural gas, uranium, and renewable energy sources. Australia also has a large services sector and is a significant exporter of natural resources, energy and food.[2]

The Department of Innovation, Industry, Science and Research is the national department responsible for science and technology. The aim of this Department is to encourage the sustainable growth of Australian industries by developing a national innovation system that drives knowledge creation, innovative science and research, international competitiveness and greater productivity.[3] Australia also has a Chief Scientist, who provides high-level, independent advice to the Australian Prime Minister and other Ministers on matters relating to science, technology and innovation. The Chief Scientist reports directly to the Minister for Innovation,

[1] Department of Science and Technology (2011) - The information (scientific areas and institutions) pertaining to the science and technology areas of co-operation with South Africa was prepared and made available by the Department of Science and Technology's Chief Directorate for Overseas Bilateral Cooperation.
[2] Central Intelligence Agency (2011).
[3] Australian Government - Department of Innovation, Industry, Science and Research (2011).

Industry, Science and Research and is the Executive Officer of the Prime Minister's Science, Engineering and Innovation Council (PMSEIC).[4]

Australia's Innovation Policy for the next ten years until 2020 is titled, *Powering Ideas — An Innovation Agenda for the 21st Century*. It outlines seven National Innovation Priorities spanning research, future industries, business engagement, collaboration and capability that Australia will pursue to become more productive and globally competitive. Australia also has four National Research Priorities, each having specific priority goals that complement the National Innovation Priorities. These research priorities are:[5]

- An environmentally sustainable Australia;
- Promoting and maintaining good health;
- Frontier technologies for building and transforming Australian industries; and
- Safeguarding Australia.

Australia's current priority science fields (part of the *Super Science* initiative) are:

- Marine science and climate;
- Space and astronomy; and
- Future industries (including biotechnology and nanotechnology).

The Scientific and Technological Co-operation Agreement between South Africa and Australia was signed in October 2006. Currently, Australia is not a high priority partner of the Department of Science and Technology (DST), though there are extensive linkages in the field of higher education. The priority areas of co-operation include the following:

- Innovation management, systems and instruments;
- Biotechnology for health and innovation;
- Low-carbon energy technologies;
- Climate change science and the Southern Indian Ocean;
- Natural resources management;
- Biodiversity and water; and
- Humanities and social sciences.

Australian institutions involved with South Africa among others include:

- The Department of Industry, Innovation, Science and Research (DIISR) works with the DST on the overall management of the S&T co-operation between the two countries through Joint Committee (JC) meetings;
- The Commonwealth Scientific and Industrial Research Organisation (CSIRO) works with the South African National Energy Research Institute (SANERI) on energy research;

[4] Australian Government - Australia's Chief Scientist (2011).
[5] Australian Government - Department of Innovation, Industry, Science and Research (2009).

- CSIRO works with the Council for Scientific and Industrial Research (CSIR) on a number of areas, for example, the built environment, energy research and climate change;
- The Australian Academy of Technology, Science and Engineering (ATSE) works with the South Africa Academy of Engineering (SAAE);
- The Australian Nuclear Science and Technology Organisation (ANSTO) works with the Nuclear Energy Corporation of South Africa (NECSA); and
- Collaboration with higher education institutions, for example, the University of Monash.

2.2 Federative Republic of Brazil

Brazil is the largest country in South America and shares common boundaries with every South American country except Chile and Ecuador. It has a population of approximately 203 million, 87 per cent of whom live in urbanised areas. Brazil comprises 26 states and one federal district. The capital city is Brasilia. Brazil has large and well-developed agricultural, mining, manufacturing, and service sectors and its economy outweighs that of all other South American countries.[6]

The Ministry of Science and Technology (Ministério da Ciência e Tecnologia - MCT) is responsible for national policy on scientific and technological research and innovation; the planning, co-ordination, supervision and control of scientific and technological activities; policies for developing information technology and automation; national policy on biosecurity; nuclear policy and control of exports of sensitive goods and services. The MCT comprises the two most important agencies for encouraging research in Brazil, namely the Financing Body for Studies and Projects (Financiadora de Estudos e Projetos - FINEP) and the National Council for Scientific and Technological Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico - CNPq) and their respective research units. In addition to these agencies, the MCT system also includes the Centre for Management and Strategic Studies (Centro de Gestão e Estudos Estratégicos - CGEE); the National Committee for Nuclear Energy (Comissão Nacional de Energia Nuclear - CNEN); the Brazilian Space Agency (Agência Espacial Brasileira - AEB); 19 research units in the area of science, technology and innovation, and four state enterprises. The state enterprises are Brazilian Nuclear Industries (Indústrias Nucleares Brasileiras - INB); Nuclebrás Heavy Equipment (Nuclebrás Equipamentos Pesados -Nuclep); Alcântara Cyclone Space (ACS) and the Centre of Excellence in Advanced Electronic Technology (Centro de Excelência em Tecnologia Eletrônica Avançada - Ceitec).

The Brazilian Technology System (SIBRATEC) co-ordinates the scientific and technological community's relationship with business. It supports technological development and provides the conditions with which to boost business innovation. In this way, it contributes to increasing revenue, productivity and competitiveness in domestic and foreign markets. SIBRATEC is organised into three types of networks, called components. These are, Innovation Centres, Technological Services, and Technological Outreach.[7]

[6] Central Intelligence Agency (2011).
[7] Brazilian Ministry of Science and Technology <http://www.mct.gov.br>.

The STI strategic priorities for Brazil are to:

- Expand and consolidate the national STI system;
- Promote technological innovation in enterprises;
- To pursue research, development and innovation (RDI) in strategic areas (Information and Communication Technologies [ICT], Health products, Biofuels, Agribusiness and the Nuclear Programme); and
- To pursue STI for social development.

The Scientific and Technological Co-operation Agreement between South Africa and Brazil was signed in 2003, but remained unimplemented until 2008. The DST classifies Brazil as a priority country for S&T co-operation. The priority areas of co-operation are:

- Agro-processing;
- Industrial technologies;
- Biodiversity;
- Biotechnology;
- Energy;
- Environmentally-friendly technologies;
- ICT;
- Materials research;
- Space science and astronomy; and
- Indigenous knowledge.

The Brazilian institutions involved with South Africa are:

- The Ministry of Science and Technology on the overall management of the S&T co-operation between the two countries through a Joint Commission on Science and Technology Co-operation (JCSTC);
- The National Council for Scientific and Technological Development (CNPq), Brazil's funding agency and a counterpart to the South African National Research Foundation (NRF), both responsible for funding and promoting scientific and technological research; and
- The Brazilian National Institute for Space Research (INPE).

2.3 People's Republic of China

China is the world's fourth largest country, after Russia, Canada and the Unites States of America (US). It has a population of approximately 1.3 billion, 47 per cent of whom live in urbanised areas. China comprises 23 provinces, five autonomous regions and four municipalities. The capital city is Beijing. In 2010, China became the world's largest exporter, being the world leader in the gross value of both agricultural and industrial output.[8]

[8] Central Intelligence Agency (2011).

The Ministry of Science and Technology for the People's Republic of China is responsible for the development and implementation of the national policy and programmes on scientific and technological research and innovation. China's scientific research system is a co-operative one, comprising the Chinese Academy of Sciences (CAS), schools of higher learning, industrial departments, national defence departments and local scientific research institutes. China has, since the 1980's, formulated a series of programmes for S&T research and development, with the strategic aim of improving China's competitiveness in S&T in the 21st century. The Key Technologies Research and Development Programme, the 863 Programme and the 973 Programme form the main body of state programmes for science and technology. The Spark and the Torch programmes further enhance China's strength in the technology arena. A concise description of each of the Programmes follows:[9]

- **Key Technologies Research and Development Programme (KTRDP):**

This programme, launched in 1982, was the biggest scientific and technological programme in China during the 20th century. The KTRDP focused on developing agriculture, electronic information, energy, transport, materials, resources exploration, environmental protection, medical care and other fields. Engaging tens of thousands of researchers in over 1 000 research institutes, the KTRDP has had the most funding, employed the most people and had the greatest impact on China's national economy of any plan to date.

- **863 Programme – National Hi-tech Research and Development Programme:**

This programme, launched in March 1986, focused on 20 themes in biology, spaceflight, information, laser, automation, energy, new materials and oceanography. It was structured so that the Chinese government exercised macro-control and gave support, but a committee of scientific experts decided which research projects would be undertaken. Two distinctive features for the selection of research projects are that it has to set a new direction in the specific field and the results should be able to be quickly industrialised.

- **973 Programme - National Basic Research Programme of China:**

This programme, launched in 1998, focused on the development of basic scientific research. It mainly involves multi-disciplinary, comprehensive research on important scientific issues in agriculture, energy, information, resources, population, health and materials. Representing China's national goals, it aims to provide strong scientific and technological support for significant issues in China's 21st century socio-economic development.

- **Spark Programme:**

Launched in 1986, the Spark Programme aims to revitalize China's rural economy through the development and popularisation of science and technology to improve the lives of the rural

[9] Ministry of Science and Technology for the People's Republic of China <http://www.most.gov.cn>.

population. Today, there are more than 140 000 S&T demonstration projects being carried out in 90 per cent of rural areas throughout China.

- **Torch Programme:**

Launched in August 1988, the Torch Programme is China's most important high-technology industry programme. It promotes the development of high-tech products that require advanced technology capabilities and have the economic potential to enter both domestic and foreign markets; therefore, aiding the establishing of high-technology industrial development zones throughout the country. The Programme focused mainly on projects in new technological fields, such as new materials, biotechnology, electronic information, integrated mechanical-electrical technology and advanced energy-saving technology.

- **The 12th Five-Year Plan – China's plan for national economic and social development:**[10]

Launched in March 2011, China's 12th Five-Year Plan emphasises higher-quality growth. Three of the seven key themes of the Plan are scientific development, environmental protection and energy efficiency. The seven priority industries are:

  - New energy – nuclear, wing and solar power;
  - Energy conservation and environmental protection – to meet energy reduction targets;
  - Biotechnology – Drugs and medical devices;
  - New materials – Rare earths and high-end semiconductors;
  - New Information Technology (IT) – Broadband networks, internet security infrastructure, network convergence;
  - High-end equipment manufacturing – Aerospace and telecom equipment; and
  - Clean energy vehicles.

China's innovation policy, put forward in the Medium- and Long-Term Plan of Science and Technology Strategic Development: 2006-2020, aims to achieve an innovation-oriented society by 2020.[11]

The Scientific and Technological Co-operation Agreement between South Africa and China was signed in 1999 and includes co-operation on:

- Biotechnology;
- ICT;
- New materials and Advanced Manufacturing technologies;
- Traditional medicines; and
- Sustainable management of environmental resources.

[10] KPMG China (2011).
[11] Organisation for Economic Co-operation and Development (OECD) (2010).

Scientific research areas such as palaeosciences and archaeology were added later through the Bi-National Commission in 2007. China is a priority partner of the DST and a number of visits and exchanges have taken place between the two countries since the signing of the agreement. The first call for project proposals was completed in March 2000 and since then, 46 joint research projects and initiatives were jointly funded in the areas of biotechnology, advanced manufacturing, ICT, palaeosciences, health (traditional medicines), transport technology, and mineral resources, amongst others.

The Chinese Ministry of Science and Technology have also been supportive of a pilot telemedicine project being run by the Medical Research Council (MRC). Most of the research projects have contributed to human capital development through exchange programmes, the training of young scientists, and publications in science journals, as well as academic papers presented at science forums and conferences. In mid-September 2011, China hosts the first Brazil, Russia, India, China, South Africa (BRICS) sectoral meeting for science and technology.

2.4 Japan

Japan is a chain of islands that comprises 47 prefectures with a population of approximately 126 million, 67 per cent of whom live in urbanised areas. The capital city is Tokyo. In the years following World War II, government-industry co-operation, a strong work ethic, mastery of high technology, and a comparatively small defence allocation helped Japan develop a technologically advanced economy. With virtually no energy natural resources, Japan is the world's largest importer of coal and liquefied natural gas, as well as the second largest importer of oil. The agricultural sector is small, highly subsidized and protected, with crop yields among the highest in the world. Japan imports about 60 per cent of its food (on a caloric basis) and maintains one of the world's largest fishing fleets, accounting for nearly 15 per cent of the global catch.[12]

Science, technology and innovation policy planning is the responsibility of the National Institute of Science and Technology Policy (NISTEP), which falls under the direct jurisdiction of the Ministry of Education, Culture, Sports, Science and Technology (MEXT). It is required of NISTEP to ascertain government needs, collaborate and co-operate with government agencies and to participate in the STI decision-making process. The 4th Science and Technology Basic Plan is the Japanese policy that will drive STI from 2011 onwards.[13]

The S&T Co-operation Agreement between South Africa and Japan was signed in August 2003. The DST has prioritised Japan as a strategic partner and at a multilateral level; both countries have maintained a good relationship as founding members of the Group on Earth Observation (GEO), which was established following the Johannesburg 2002 World Summit.

Under the S&T Agreement, the two countries co-operate through joint R&D projects on specific research areas via calls for proposals. The progress on co-operation is normally evaluated and

[12] Central Intelligence Agency (2011).
[13] Japan's Ministry of Education, Culture, Sports, Science and Technology <http://www.mext.go.jp/english/>.

reviewed by the Joint Committee for Science and Technology during its biannual meetings. The NRF has signed two Memoranda of Understanding (MoU) with Japanese funding agencies – the Japan Society for the Promotion of Science (JSPS) in 2004 and the Japan Science and Technology (JST) Agency in 2008 – for managing the joint R&D projects between the two countries. South Africa benefits significantly from Japanese development assistance.

The priority research areas include:

- Life sciences;
- Environment and climate change;
- Energy research;
- Human capital development;
- Material science; and
- Nanotechnology.

The Japanese institutions involved with South Africa among others include:

- The Japanese Ministries of Education, Culture, Sports, Science and Technology and of Foreign Affairs (MOFA) are both involved with the DST in the management of the science and technology co-operation programme, including the Official Development Aid for science and technology projects;
- The Japanese Oil, Gas and Metals National Corporation (JOGMEC) works with the Council for Geosciences (CGS) in rare earth metals research, and with Mintek on bioleaching and mineral resource processing technology;
- The Earth Simulator Centre of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) works with the Centre for High Performance Computing of the CSIR on earth observation and visualisation; and
- The Japanese universities such as Tohoku University works with the University of Cape Town (UCT) on nuclear engineering, and Kyushu University works with UCT and the University of the North West on hydrogen technology and materials engineering.

2.5 Malaysia

Malaysia comprises 13 states and has a population of approximately 29 million, 72 per cent of whom live in urbanised areas. The capital city is Kuala Lumpur. Malaysia is attempting to achieve high-income status by 2020 and to move farther up the value-added production chain by attracting investments in Islamic finance, high-technology industries, biotechnology and services. The current administration is trying to reduce the economy's dependence on exports. Nevertheless, exports - particularly of electronics, oil and gas, palm oil and rubber - remain a significant driver of the economy.[14]

The Ministry of Science, Technology and Innovation (MOSTI) is the lead ministry that formulates policies in the area of science, technology and innovation. MOSTI also implements many programmes related to the promotion of S&T and national R&D activities. The National Council

[14] Central Intelligence Agency (2011).

for Scientific Research and Development (NCSRD) is an advisory body comprising high-level representatives from the public and private sectors whose main function is to provide advice and directions on S&T policies and S&T priorities. The prevailing STI policy is known as the Second National Science and Technology Policy (STP II), which was launched in 2003. The STP II addresses seven key priority areas, which have a strong influence on the innovation system. These are:[15]

- Strengthening research and technological capacity and capability;
- Promoting commercialisation of research outputs;
- Developing human resource capacity and capability;
- Promoting a culture for science, innovation and techno-entrepreneurship;
- Strengthening institutional framework and management for S&T and monitoring of S&T policy implementation;
- Ensure widespread diffusion and application of technology, leading to enhanced market-driven;
- R&D to adapt and improve technologies; and
- Build competence for specialisation in key emerging technologies.

Currently, there is no science and technology co-operation agreement with Malaysia. Previous discussions on areas of co-operation resulted in the following areas being agreed as areas of focus in the event an agreement should be pursued. However, the DST currently has no interest in pursuing a co-operation agreement with Malaysia. The agreed-upon areas are:

- Biotechnology;
- Nanotechnology;
- Photonics (Malaysia is one of the leading countries);
- ICT; and
- Innovation (ICT innovation is one of Malaysia's strengths).

In the absence of an S&T agreement, only the CSIR and the Standard and Industrial Research Institute of Malaysia (SIRIM) have active engagements.

2.6 Republic of Singapore

Singapore comprises islands located between Malaysia and Indonesia. It has a population of approximately 4 million, all of whom live in urbanised areas. The capital city is Singapore. Singapore has a highly developed and successful free-market economy. It enjoys a remarkably open and corruption-free environment, stable prices and a per capita Gross Domestic Product (GDP) higher than that of most developed countries. The economy depends heavily on exports, particularly in consumer electronics, information technology products, pharmaceuticals, and on a growing financial services sector.[16]

[15] Malaysian Ministry of Science, Technology and Innovation <http://www.mosti.gov.my/mosti/>.
[16] Central Intelligence Agency (2011).

Singapore's five-year National Science and Technology Plan emphasises the need to build on three areas to achieve 'translational competency', these are nurturing local talent, recruiting global talent and working with industry to promote technology development and transfer. Co-ordination for implementing the plan is divided between the Agency for Science, Technology and Research (A*STAR) for public sector activities and the Economic Development Board for private sector activities. The national approach has been to cluster key research agencies geographically to provide a national knowledge hub with ties to institutes abroad that are world-renowned for scientific endeavour in two key areas: ICTs and biomedical research. To achieve this, the Science and Engineering Council has drawn together seven research institutions concerned with ICT to create *Fusionopolis* and the Biomedical Research Council has created a cluster of five key biomedical research institutes to form *Biopolis*. These two clusters are at the heart of Singapore's drive to create global centres of excellence in these two niche areas.[17,18]

There is no S&T co-operation agreement between South Africa and Singapore. Although, attempts were made to start relations, Singapore was not interested in working with South Africa in the fields of science, technology and innovation.

2.7 The Republic of Korea (South Korea)

South Korea comprises nine provinces and seven metropolitan cities. It has a population of approximately 49 million, 83 per cent of whom live in urbanised areas. The capital city is Seoul. South Korea has achieved an incredible record of growth and global integration to become a high-tech industrialized economy and is currently among the world's 20 largest economies. The South Korean economy's long-term challenges include a rapidly aging population, inflexible labour market and an over-dependence on manufacturing exports to drive economic growth.[19]

The Ministry of Science and Technology is responsible for formulating and implementing STI policy in South Korea. The current national R&D programmes include the:

- 21st Century Frontier R&D Programme – aims to develop scientific and technological competitiveness in newly emerging areas such as bioscience, nanotechnology and space technology;
- Creative Research Initiative (CRI) - symbolises the policy shift in S&T development in Korea "from imitation to innovation." It aims to strengthen the national potential for technological competitiveness through creative basic research. Therefore, it focuses on exploring various phenomena that occur in nature, developing new fields of scientific research and making technological breakthroughs;
- National Research Laboratory (NRL) – aims to foster research centres of excellence, which will play a pivotal role in improving technological competitiveness;
- Biotechnology Development Programme - aims to attain technological competitiveness in the areas of biotechnology, with a view to joining the ranks of the G-7 by the year 2010;

[17] Singapore - Agency for Science, Technology and Research <http://www.a-star.edu.sg>.
[18] UNESCO Science Report (2010).
[19] Central Intelligence Agency (2011).

- Nanotechnology Development Programme – aims to become one of the leading nations in the world in this field and have established a Nano-Fabrication Centre and a National Nanofab Centre for human resource development. The government has also launched several ambitious projects in such areas as nano-electronic and nano-photonics devices; and
- Space and Aeronautics Programme - aims to acquire core and fundamental technologies in the key areas of space and aeronautics. According to the National Long Term Space Development Plan, seventeen satellites will be launched, including four communication satellites, seven multi-purpose satellites and six scientific satellites by the year 2015. The basic objective of this plan is to develop indigenous capability in satellite technology, including launch capability, by the year 2015.[20]

The S&T co-operation agreement between South Africa and South Korea was signed in February 2004. South Korea is a priority partner of the DST, and in 2004 and 2005, South African delegations visited South Korea to sign the agreement and gain a better understanding of their national system of innovation.

The current S&T areas of co-operation include:
- Space science and astronomy;
- Nuclear energy;
- Biotechnology;
- Nanotechnology;
- Innovation; and
- Hydrogen and fuel cells.

Several South African institutions collaborate with South Korean institutions. These are, amongst others, the Korea Astronomy and Space Science Institute (KASI), the Korea Research Institute of Bioscience and Biotechnology (KRIBB), the Korean Institute of Science and Technology (KIST), the Korean Atomic Energy Research Institute (KAERI), the Korea Institute of Energy Research (KIER), Samsung Advanced Institute of Technology, Kyungpook National University and the Hankook Tire Company.

[20] Korean Ministry of Education, Science and Technology <http://www.mest.go.kr>.

3. Gross and Business Expenditure on R&D[21,22]

Indicator	South Africa	Australia	Brazil	China	Japan	Malaysia	Singapore	South Korea
Gross expenditure on R&D (% of GDP)	0.92% (2008)	2.17% (2009)	1.1% (2008)	1.5% (2008)	3.4% (2008)	0.64% (2006)	2.52% (2009)	3.21% (2007)
Business expenditure on R&D (% of GDP	0.6% (2008)	1.2% (2007)	0.5%[23] (2008)	1% (2008)	2.7% (2008)	–	1.9% (2008)	2.5% (2008)

4. Global Competitiveness Index[24]

Indicator	RANK OUT OF 142 COUNTRIES							
	South Africa	Australia	Brazil	China	Japan	Malaysia	Singapore	South Korea
Overall country ranking	50	20	53	26	9	21	**2**	24
Quality of math and science education	138	19	127	31	24	23	**1**	12
Capacity for innovation	46	27	31	23	**1**	19	22	20
Company spending on R&D	36	27	30	23	**1**	13	10	11
Quality of science research institutions	30	13	42	38	**11**	24	12	25

[21] OECD (2010).
[22] The World Bank <http://www.worldbank.org>.
[23] To improve business expenditure on R&D, Brazil affords business a 25.5 per cent tax credit on R&D.
[24] World Economic Forum (2011)

References

Australian Government - Australia's Chief Scientist. [Internet] < http://www.chiefscientist.gov.au> Accessed 9 September 2011.

Australian Government - Department of Innovation, Industry, Science and Research. (2009) *Powering Ideas — An Innovation Agenda for the 21st Century.*

Australian Government - Department of Innovation, Industry, Science and Research. [Internet] <http://www.innovation.gov.au> Accessed 5 September 2011.

Brazilian Ministry of Science and Technology. [Internet] <http://www.mct.gov.br> Accessed 5 September 2011.

Central Intelligence Agency – The World Factbook. [Internet] <https://www.cia.gov/library/publications/the-world-factbook> Accessed 8 September 2011.

Department of Science and Technology. (2011) Personal communication via email, 12 September. [Information made available by the Chief Directorate for Overseas Bilateral Co-operation].

Japan's Ministry of Education, Culture, Sports, Science and Technology. [Internet] <http://www.mext.go.jp> Accessed 6 September 2011.

Korean Ministry of Education, Science and Technology. [Internet] <http://www.mest.go.kr> Accessed 8 September 2011.

KPMG China. (2011) *China's 12th Five-Year Plan: Overview.* [Internet] <http://www.kpmg.com/cn> Accessed 13 September 2011.

Malaysian Ministry of Science, Technology and Innovation. [Internet] <http://www.mosti.gov.my> Accessed 8 September 2011.

Ministry of Science and Technology for the People's Republic of China. [Internet] <http://www.most.gov.cn> Accessed 5 September 2011.

Organisation for Economic Co-operation and Development. (2010) *OECD Science, Technology and Industry Outlook.*

Singapore - Agency for Science, Technology and Research. [Internet] <http://www.a-star.edu.sg> Accessed 12 September 2011.

UNESCO Science Report. (2010) *Southeast Asia and Oceana.* [Internet] <http://www.sea-eu.net/attach/UNESCOSciencereportSEA.pdf>. Accessed 13 September 2011.

The World Bank. [Internet] <http://www.worldbank.org>. Accessed on 12 September 2011.

World Economic Forum. (2011) *The Global Competitiveness Report 2011-2012.* [Internet] <http://www.weforum.org>. Accessed 9 September 2011.