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# The European Union and Singapore: R&D cooperation for the future

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# **Singapore and the European Union:** R&D cooperation for the future



## Foreword

The European Union's Seventh Framework Programme for Research and Technological Development, FP7, is Europe's principal instrument for funding scientific excellence. The funding appropriated for FP7 is channelled to a number of dedicated initiatives designed and developed to create the European Research Area (ERA), the EU's single market for research and innovation.

European decision-makers have realised early, however, that for the ERA to be most effective, its scope must not be limited to Europe's physical or political frontiers. The EU must seek strategic cooperation with like-minded partners to fully reach its goal of becoming home to the largest knowledge-based economy in the world. In this respect, Singapore quickly emerges as a natural ally.

Not only has Singapore been an important trading partner and investment location for Europe for many years, but it too has identified R&D as being at the crux of its long-term economic competitiveness. Singapore has set for itself similar objectives and adopted comparable approaches to research that make it a natural partner for cooperation under FP7. Singapore has been active in previous Framework Programmes, particularly in the area of information technologies, and Europe would like to encourage cross-the-board participation in the current Framework Programme. Singapore has made impressive strides in becoming an international hub for research; and this, coupled with its location in the heart of the ASEAN region with a huge growth potential make it an ideal partner for Europe in its drive towards research excellence. This brochure will serve as a way to highlight those areas where Europe's and Singapore's respective R&D strategies are complementary, as well as a guide to finding practical information on cooperation opportunities.

Singapore and the EU enjoy close ties at many levels and across all sectors, including political, economics, educational and cultural sectors. These ties have grown from strength to strength over the years.

In the areas of R&D, Singapore's involvement in projects organized by the European Commission started more than 10 years ago in 1994 with the 4th Framework Programme. Since then, we have seen significant increases in the number of proposals involving Singapore-based organizations. The Framework Programme remains an excellent platform for Singapore to cooperate with the EU in Science and Technology — valuable lessons on best practices in R&D project management were shared and learnt through interactions between our research organizations. Under the 6th Framework Programme (FP6), several successful projects were undertaken by European partners and Singapore, and we are looking forward an enhanced dialogue in FP7.

In recent years, Singapore has placed greater emphasis on R&D. We are now into our fourth five-year S&T Plan, with R&D funds directed at areas with potential for scientific breakthroughs and economic impact for Singapore. New areas identified include Environmental and Water Technologies, the Interactive and Digital Media, and Life Sciences. Since the start of the National Science & Technology Plan, Singapore's Gross Expenditure on R&D (GERD) as a percentage of GDP has increased from 0.85% in 1990 to 2.39% in 2006. Going forward, the Singapore government will continue to make significant investments in R&D with the aim of achieving 3% GERD by 2010.

To sustain R&D growth, Singapore realizes the critical value of collaborating with our EU partners and seeks to promote active exchanges between our research establishments and universities. This is done through a strategic top-down comprehensive approach as well as through bottom-up institution-to-institution linkages. I hope that research institutes, businesses and researchers within the EU will find the information in this brochure useful. I look forward to stronger links with our EU partners through the educational, industrial and scientific communities to foster world-class scientific research and develop top-notch scientific talent.

**José Manuel  
Silva Rodríguez**  
Director General  
for Research  
European Commission



**Lim Chuan Poh**  
Chairman  
A\*STAR





# The European Union and Singapore: TOWARDS A KNOWLEDGE-BASED FUTURE

## Singapore: a haven of knowledge

If Singapore's R&D strategy could be represented by a single geographic location, it would be found one degree north of the equator. Located there, composed of a rambling network of state-of-the-art research institutes with clusters of educational facilities, private sector offices, government outposts and trendy cafés seamlessly interwoven throughout, is the 'one-north' community. One-north's design and philosophy embody where Singapore is, as well as where the city-state is heading in the world of pre-eminent research destinations.

Singapore has plunged itself headlong into a drive towards a knowledge-based economy, and has equipped itself accordingly, to meet its goal of becoming a top-tier hub of international research and technological development, not only regionally but globally. Singapore has built up an impressive infrastructure of cutting-edge laboratories, with one-north serving as the epicentre, and populated them with some of today's best and brightest scientists.

However, as predominant as one-north is in Singapore's research-driven economic ecosystem, it is just one part of the island country's dedicated approach to cultivating an atmosphere of market-driven research, and opportunities abound for anyone who wants to take part. Being a city-state has inherent advantages and limitations, and Singapore has responded with an R&D strategy that is decidedly international in scope. Europe is well placed to take advantage of all that is on offer in terms of international R&D cooperation.

At the beginning of this millennium, when government leaders in Singapore were interested in learning how best to structure their future economy, it was Europe they turned to for guidance. They felt that Europe could offer lessons on how to leverage home-grown expertise whilst fostering international exchange so as to create sustainable advanced economies for many years to come. They visited Europe's most technologically advanced industries to learn how to focus on those sectors where they could excel in the global market, while shoring up traditional sectors to ensure they remain viable in the face of raising competition. As a result, Singapore is fast becoming a key partner for Europe as they have each tied future economic

success to the ability to create stimulating environments that cultivate new ideas, attract the brightest minds, house world-class institutions, produce blue-chip innovators and translate them all into economic prosperity.

## Building upon a history of research excellence

Singapore-based researchers and research centres have figured prominently in previous EU Framework Programmes, and Europe is counting on this strategic partnership to continue a tradition of scientific excellence. Singaporean participants have recorded impressive success rates when applying for membership in Framework Programme research consortia. For example, under the EU's previous R&D funding scheme, FP6, nearly 90% of applications for funding in the critical Information Society Technology theme were accepted. This exceptional figure reflects both Singapore's emergence as a leader in IST research and Europe's desire to increase cooperation with Singapore in this enabling field. Europe's top R&D decision-makers are dedicated to ensuring that such fruitful cooperation continues in FP7.

## Recognition of Singapore as a world leader in research

Singapore has emerged as a world-class research performer in its own right. Successes in economic growth and performance at home have slightly changed Singapore's status as a third country partner under FP7, and as a consequence, its research institutes are now ineligible for direct funding. This does not mean that Singapore cannot participate, however; there are still countless opportunities for Singaporean institutions, and Europe will continue to encourage Singapore's participation as an invaluable member of research consortia. Singaporean partners can participate as full members of a project consortium, and they will continue to be important partners in FP7 research, even though their financial support will come from one of the numerous sources at home. Individual researchers are still eligible for direct funding under the current Framework Programme, and are encouraged to visit the CORDIS website enumerating open calls, to find those most appropriate for them.



# Singapore's Key Actors in Research

## S&T Plan 2010: Leveraging Expertise, Cultivating Excellence

Similar to the EU's Seventh Framework Programme, Singapore has mapped out its R&D objectives via the Strategic Direction for S&T Policy (2006-2010), or S&T Plan 2010. S&T Plan 2010 defines specific targets and details a dedicated strategy designed to secure Singapore's position as a pre-eminent R&D hub.

In 2004, Singapore formed the Ministerial Committee on Research and Development (MCRD) chaired by the prime minister. The MCRD drafted a bold vision for Singapore's economic future, starting with the implementation of a National R&D Framework.

<http://app.mti.gov.sg/>

### Research, Innovation and Enterprise Council (RIEC): a policy leader

The RIEC is chaired by the Prime Minister and leads the national drive to promote research, innovation and enterprise by encouraging new initiatives for knowledge creation in science and technology. Members of the council include cabinet ministers, prominent industry leaders and internationally respected scientists and educators, and will help pave the way towards a knowledge-based economy.

### National Research Foundation (NRF): long-term thinking

It is the NRF's role to implement national research, innovation and enterprise strategies set by the Research Innovation and Enterprise Council (RIEC) chaired by the Prime Minister, and allocate the requisite funding. NRF works with different government agencies to develop plans and policies to bring the five strategic thrusts of the national R&D agenda to fruition. The five strategies are to:

- provide more resources for R&D and continued high-level attention on R&D;
- focus on selected areas of economic importance;
- balance investigator-led and mission-oriented research;
- encourage more private sector R&D;
- strengthen linkages between R&D and business.

The NRF has also identified several strategic R&D areas for which it feels Singapore has some competitive advantage over the long term, on a global scale.

*'R&D has to be elevated to a national priority.'*

*Dr Francis Yeoh,  
Chief Operating Officer National Research*

These are:

- Biomedical Sciences
- Environmental and Water Technologies
- Interactive Digital Media.

<http://www.nrf.gov.sg/>

### Economic Development Board (EDB)

The EDB's mission is to create sustainable economic growth and business opportunities in Singapore by attracting multinationals to open R&D centres there.

### Agency for Science Technology and Research (A\*STAR): public leader for international cooperation

A\*STAR's mission is to foster world-class scientific research and nurture world-class scientific talent to advance Singapore's economic goals. It plays a central role in setting the thematic priorities for public research. The close integration of A\*STAR's R&D with economic development objectives is meant to strengthen Singapore's ability to attract research-intensive manufacturing projects from multinational companies, deepen capabilities in existing industry clusters, and upgrade local enterprise.

*'Singapore, the sixth most water stressed country in the world, has a very difficult job to do to provide high quality water at a very affordable price, so for that job they have teamed up with Delft Hydraulics and NUS. The accelerating factor in the government's decision is that water is one of those areas where they can succeed long term.'*

*Dr Vladan Babovic,  
Professor, National University Singapore  
Director of Singapore Delft Water Alliance*

### International R&D Collaboration

Research collaborations are undertaken through Singapore's research institutions and their individual researchers and research groups. A\*STAR encourages its research institutes (RIs) to collaborate with other research institutions whenever possible. Opportunities abound; it is only a matter of researchers identifying the research institution of their corresponding interest and contacting them directly. Most institutions accept applications year-round. For a comprehensive overview of A\*STAR and its research programmes, please visit: [www.a-star.edu.sg](http://www.a-star.edu.sg)

### A\*STAR comprises four organisational units:

- Biomedical Research Council (BMRC)
- Science & Engineering Research Council (SERC)
- A\*STAR Graduate Academy (A\*GA)
- Exploit Technologies Pte Ltd.

*'Our philosophy is to encourage companies to cooperate with our research institutes, taking advantage of what we have to offer. What can Singapore offer? We invest in our people, we invest in infrastructure, we make the environment as competitive as possible.'*

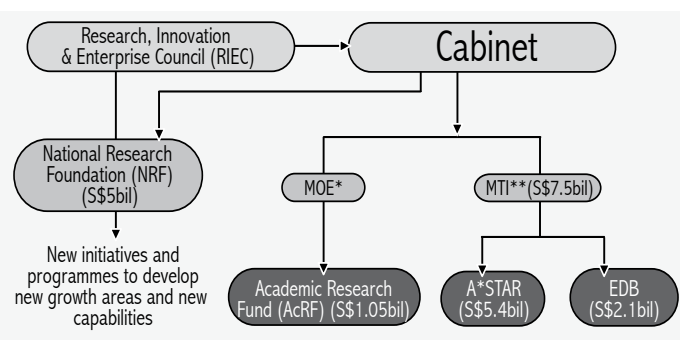
*Mr Aylwin Tan,  
Economic Development Board of Singapore*



### Universities/Polytechnics: essential actors

Within universities, focus will be given to faculty-led research. Singapore has made every effort to make the culture of research as fluid as possible. This research can be carried out independently or in collaboration with other public and private sector institutions.

Polytechnics will focus on research which is more developmental in nature, with greater focus on strengthening the nexus between R&D and business through joint projects with industry and local enterprises.



Singapore's National R&D Framework: \*MOE - Ministry of Education; \*\*MTI - Ministry of Trade and Industry

## The European Union's Seventh Framework Programme – FP7

**Knowledge lies at the heart of the European Union's Lisbon Strategy to become the 'most dynamic competitive knowledge-based economy in the world'. The 'knowledge triangle' — research, education and innovation — is a core factor in European efforts to meet the ambitious Lisbon goals. Numerous programmes, initiatives and support measures are carried out at EU level in support of knowledge.**

The Seventh Framework Programme (FP7) bundles all research-related EU initiatives together under a common roof, effectively playing a crucial role in reaching the goals of growth, competitiveness and employment. It is accompanied by a new Competitiveness and Innovation Framework Programme (CIP), Education and Training programmes, and Structural and Cohesion Funds for regional convergence and competitiveness. It is also a key pillar for the European Research Area (ERA).

The broad objectives of FP7 have been grouped into four specific programmes: Cooperation, Ideas, People and Capacities. For each type of objective, there is a specific programme corresponding to the main areas of EU research policy. All specific programmes work together to promote and encourage the creation of European poles of (scientific) excellence. For further information on FP7, please visit: [www.cordis.europa.eu/fp7](http://www.cordis.europa.eu/fp7)

## FP7: A New Approach to International S&T Cooperation

Due to the nature of a globalised economy, market-relevant R&D is no longer a solitary endeavour. Increasingly, individual researchers and research institutions are pooling their unique strengths and complementary skills to reach common solutions. Cross-border and interdisciplinary approaches to mutual challenges will power the next generation of discovery, pushing the envelope of both frontier research, as well as dedicated product development. With this in mind, European policymakers have developed a new approach to international R&D. Compared with its predecessor, FP7's international perspective is significantly different. This outlook has been factored into every aspect of the current Framework Programme. FP7 has adopted three basic principles regarding international cooperation.

It has programmed specific priorities for third countries and regions, targeted specific actions for third countries, and made way for the establishment of a partnership and dialogue for third countries and regions. As a general principle, FP7 is open to participation from any country in the world. The procedures for participation and funding possibilities vary for different groups of countries. To download a copy of the EU's New Approach to International S&T Cooperation, please visit:

[www.ec.europa.eu/research/iscp/pdf/newapproach\\_en.pdf](http://www.ec.europa.eu/research/iscp/pdf/newapproach_en.pdf)

## The four specific programmes of FP7

**FP7 is principally divided into four pillars, with international cooperation activities available in each. The international dimension is no longer confined to a specific scientific and technological (S&T) cooperation programme, but is now inherent in all European Community research activities.**

### Cooperation

By far the most prominent part of FP7, the 'Cooperation' programme funds transnational research collaboration in individual themes, including several that mirror Singapore's long-term R&D strategy, such as Information & Communication Technologies (ICT), Health, Environment and Climate Change, and Nanosciences, Nanotechnologies, Materials & New Production Technologies (NMP). Singaporean researchers are sure to find calls here for proposals that coincide with their research interests. Furthermore, they are encouraged to participate as members



of research consortia in all themes.  
[www.cordis.europa.eu/fp7/cooperation/](http://www.cordis.europa.eu/fp7/cooperation/)

### Ideas

The 'Ideas' programme funds investigator-driven frontier research to ensure that Europe becomes the touchstone of tomorrow's R&D. Singaporean researchers are eligible to submit projects for funding, provided that their research is carried out in an EU Member State or Associated Country to FP7.

[http://cordis.europa.eu/fp7/ideas/home\\_en.html](http://cordis.europa.eu/fp7/ideas/home_en.html)

### People

Great research is driven by great minds, and the 'People' pillar is designed to attract the brightest minds from across the globe. The 'People' programme is centred around the highly successful Marie Curie actions, which help researchers fulfil their research aspirations abroad. A renewed emphasis is being placed on the international dimension of the Marie Curie actions, and Singaporean researchers are encouraged to take advantage of the

opportunities open to them.  
[http://cordis.europa.eu/fp7/people/home\\_en.html](http://cordis.europa.eu/fp7/people/home_en.html)

### Capacities

The 'Capacities' pillar aims to establish Europe as a global leader in R&D through strategic partnerships and through the promotion of global synergies. The 'Capacities' programme will coordinate EU research programmes with those of other countries by bringing together policy makers, the scientific community, civil society and private sector stakeholders from the EU and third countries to identify priorities and define policy orientations. Singapore will obviously have a role to play in this strategy.

[http://cordis.europa.eu/fp7/capacities/home\\_en.html](http://cordis.europa.eu/fp7/capacities/home_en.html)

For further information on participating in FP7 and how to submit a proposal if you are based outside of the EU, please visit:

[www.cordis.europa.eu/fp7/public\\_en.html](http://www.cordis.europa.eu/fp7/public_en.html)  
<http://ec.europa.eu/research/iscp>

## Agency for Science, Technology and Research (A\*STAR)

### A\*STAR's twin clusters for Biomedical Sciences and Engineering Research

*The world-renowned life sciences researcher was asked why he chose Singapore as his base after studying in western universities.*

*'The infrastructure in Singapore and the encouragement and support one gets here from the higher echelons of the government, all the way down, is phenomenal. The environment is very conducive for someone to shine.'*

*Dr Ariff Bongso,  
 the first ever to derive embryonic stem cells from blastocysts.*

## BMRC

### Driving excellence in biomedical research

The Biomedical Sciences Initiative in Singapore aims to develop Singapore into the Biopolis of Asia — an international biomedical sciences hub advancing human healthcare, through the pursuit of excellence in research & development, manufacturing, and healthcare delivery.

BMRC spearheads the Biomedical Sciences initiative in close partnership with the Singapore Economic Development Board's (EDB) Biomedical Sciences Group and Bio\*One Capital as well as the Ministry of Health's National Medical Research Council.

During the first phase of development (2000-2005), BMRC focused on establishing a firm foundation of basic biomedical research in Singapore. In the second phase, from 2006

to 2010, of its Biomedical Sciences Initiative, the focus is on deepening our basic research capabilities and strengthening translational and clinical research (TCR), to help realise the full potential of our investments in the BMS initiative with the translation of laboratory discoveries to clinically useful and commercially viable applications.

### Role of the Biomedical Research Council (BMRC)

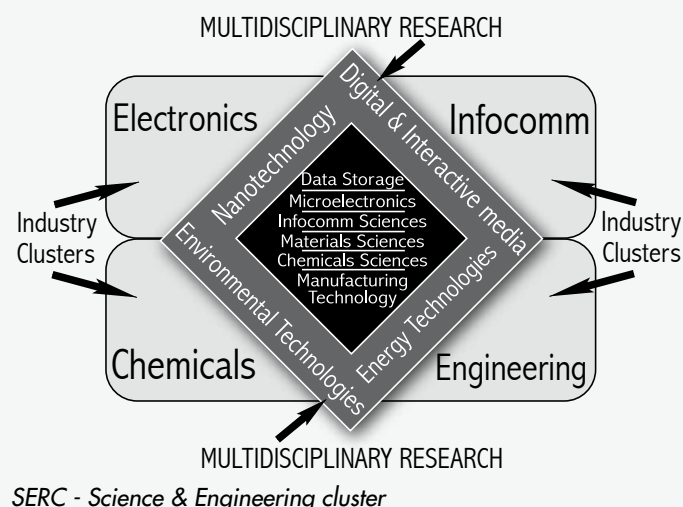
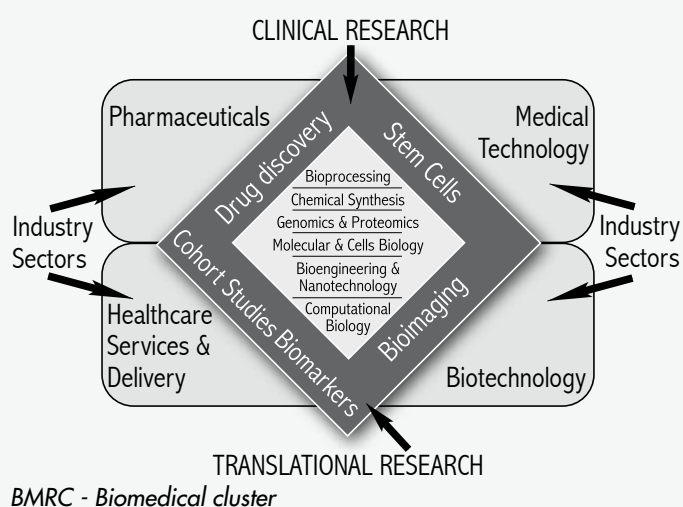
Established in 2000, the Biomedical Research Council (BMRC) stimulates and supports the creation of new knowledge and technologies to advance healthcare and improve the quality of life in Singapore and Asia. There are seven research institutes (RIs) under BMRC:

- Bioinformatics Institute (BII)
- Bioprocessing Technology Institute (BTI)
- Genome Institute of Singapore (GIS)
- Institute of Bioengineering and Nanotechnology (IBN)
- Institute for Medical Biology (IMB)
- Institute of Molecular and Cell Biology (IMCB)
- Singapore Institute for Clinical Sciences (SICS).

BMRC has established the following research units to focus on developing capabilities in translational research:

- Singapore Cancer Syndicate (SCS)
- Singapore Bioimaging Consortium (SBIC)
- Singapore Stem Cell Consortium (SSCC)
- Singapore Immunology Network (SIgN)
- Singapore Consortium for Cohort Studies (SCCS)
- Experimental Therapeutics Centre (ETC).





BMRC oversees the development of core biomedical research capabilities to support Singapore's key biomedical industry clusters: pharmaceuticals, biologics and biotechnology, medical technology and healthcare services and delivery. BMRC has established research units specialising in bioprocessing, chemical synthesis, genomics and proteomics, molecular and cell biology, bioengineering and nanotechnology and computational biology. BMRC also supports biomedical research in the wider extramural community including the local universities, hospitals and disease centres through its extramural grants.

In order to take discoveries at the 'bench' to clinical applications at the 'bedside', BMRC has established various consortia to coordinate and drive translational research at the national level in strategic thematic areas such as cancer, bioimaging, stem cells, immunology and cohort studies.

In addition to establishing research networks and partnerships in Singapore, BMRC also nurtures collaborations with RIs and universities in Europe, including UK, France, Sweden, Germany and Hungary, as well as with the USA, Australia and Japan, creating opportunities for scientific exchange, joint discovery and manpower training.

In order to develop the human capital necessary to support the biomedical R&D in Singapore, BMRC has successfully attracted international scientific talent to contribute to our BMS Initiative. BMRC has recruited numerous world-renowned scientific luminaries to Singapore to provide research leadership in its RIs, such as Professor Sir David Lane, codiscoverer of the p53 tumour suppressor gene, and Professor Judith Swain, prominent clinician-scientist. These eminent scientists attract other scientists, graduate students and postdocs, as well as important research partnerships and grants. BMRC RIs provide a training ground for local PhD students and research technicians, who are necessary to support and sustain the R&D activity as well as the growth of Singapore's BMS industry sector.

SERC supports Singapore's four key manufacturing industry sectors in Electronics, Infocomm & Media, Chemicals, and Engineering. SERC RIs develop relevant technologies and capabilities to meet the needs of manufacturing industries. SERC also actively helps local enterprises improve their global competitiveness through the GET-Up Scheme. Here, SERC RIs play a pivotal role in providing technical assistance and manpower transfer to Singapore local companies. SERC will continue to invest in technological developments that will help anchor companies in Singapore and help local enterprises compete effectively in the global markets. Only with knowledge arising from deep engagement in R&D, will SERC understand the technological trends needed to renew capabilities so as to help local companies take advantage of new market opportunities and growth industries.

## SERC

### Multidisciplinary engineering R&D leader

In addition to branching out into new strategic areas of R&D, Singapore is also renewing its investment in traditional areas of expertise at home. Through the Science and Engineering Research Council institutes, Singapore's four key manufacturing industry sectors (electronics, infocomm and media, chemicals and engineering) will benefit from dedicated initiatives to help local enterprises maintain a world-renowned reputation. Singapore has long been home to a highly educated, highly trained workforce, and the SERC will help ensure R&D initiatives aid local businesses in harnessing this potential.

#### Electronics

SERC remains committed to developing new capabilities to meet the future needs of industry both at home and abroad, to ensure that Singapore maintains its position as data storage capital of the world. Through its nanotechnology initiative, SERC will provide industry with the tools needed to address technical barriers as technology approaches atomic levels.



## Infocomm & Media (ICM)

SERC has set its sights on increased productivity in communications, information science and media technologies – the principle enablers of ICM, according to SERC. As ICM increasingly becomes a part of everyday life, SERC

*'Eighty percent of high-performance disk drives for business applications is manufactured in Singapore. The content of the disk drive industry in Singapore has changed significantly over the years. Although Singapore's global market share for total disk drive production has dropped, the storage industry has also shifted focus to network storage and enterprise drives manufacturing as well as key component production and R&D, which are knowledge-intensive and innovation-driven.'*

*Prof. Chong Tow Chong,  
Executive Director,  
Science and Engineering Research Council (SERC)*

will make sure that Singapore is prepared to capitalise on new opportunities in digital entertainment, digital health-care and digital home/work environments.

## Chemicals

Singapore's chemicals industry has diversified in recent years to prepare for upcoming challenges in the global market. Chemicals R&D will further ensure that Singapore is well-placed to contribute to the global market, as well as to provide industry with the requisite expertise and technology needed to remain competitive long term.

## Engineering

SERC will leverage from a pool of talent in Singapore's universities and polytechnics to support the engineering cluster across multiple disciplines, including transport, logistics and environmental engineering. These SERC Research Institutes include:

- Data Storage Institute (DSI)
- Institute for Infocomm Research (I<sup>2</sup>R)
- Institute of Chemical & Engineering Sciences (ICES)
- Institute of High Performance Computing (IHPC)
- Institute of Materials Research and Engineering (IMRE).
- The Institute of Microelectronics (IME)
- Singapore Institute of Manufacturing Technology (SIMTech)
- The A\*STAR Computational Resource Centre (A\*CRC)
- The Chemical Synthesis Laboratory @ Biopolis
- The SERC Nanofabrication and Characterisation (SNFC).

## Biopolis and Fusionopolis Science parks of tomorrow

An integral part of Singapore's R&D strategy is the 'one-north' community. At one-north, Singapore has literally blurred the lines between research and enterprise, between the national and global scales, and between work and creativity. It has been designed as an environment where research, innovation, inspiration and business acumen are meant to meld into a singular ethos. The philosophy behind one-north aptly conveys Singapore's belief that R&D can transform the economic future of a country. Here, researchers, students, industry representatives and policymakers alike are given the opportunity to come together and engage in an informal exchange of ideas in a place that pulls together practically every member of the value chain. Singapore's policymakers have taken an active role in building up an infrastructure that allows the knowledge-based economy to take root. One-north is touted as Singapore's 'icon of the knowledge economy' and as the place 'where ideas grow'.

One-north is anchored physically and conceptually around Biopolis and Fusionopolis, two world-class research parks with some of the brightest minds in science from around the globe leading the research institutes there. Top-tier scientists have been hand-picked to come to Singapore and spearhead efforts to turn knowledge into the country's single largest natural resource. Singapore has taken

### Research stakeholders at Biopolis:

#### Genome

- Genome Institute of Singapore (GIS)
- Swiss House Singapore
- EDB Biomedical Sciences Group (BMSG)
- Bio\*One Capital Singapore

#### Matrix

- Bioinformatics Institute (BII)
- Exploit Technologies Pte Ltd (ETPL)
- Science and Engineering Research Council

#### Nanos

- Institute of Bioengineering and Nanotechnology (IBN)
- Experimental Therapeutics Centre (ETC)
- Singapore Institute for Clinical Sciences (SICS)

#### Centros

- Agency for Science, Technology and Research (A\*STAR)
- Biomedical Research Council (BMRC)
- Bioprocessing Technology Institute (BTI)

#### Helios

- Bioethics Advisory Committee (BAC)
- Singapore Bioimaging Consortium (SBIC)
- Chemical Synthesis Laboratory
- British High Commission S&T Office
- RIKEN Office

#### Proteos

- Institute of Molecular and Cell Biology (IMCB)

#### Neuros

- Singapore Immunology Network (SIgN)
- Institute of Medical Biology (IMB)



to heart the theory that where there is an abundance of knowledge and a highly skilled workforce, industry will soon follow, and their strategy seems to be paying off. In 2004, European foreign direct investment in Singapore topped 1.15 billion SGD. If current trends continue, Singapore's venture into a market-driven knowledge economy has a very bright future indeed.

## Biopolis

The official opening of the Biopolis on 29 October 2003 was a major milestone for Singapore and its research community. Biopolis Phase 1, which offers a built-up area of 185,000m<sup>2</sup>, consists of 7 buildings linked by skybridges; of these, 5 buildings house BMRC's research institutes, while the remaining buildings are occupied by private sector R&D laboratories. This co-habitation has fostered closer collaboration and intellectual exchange between public research institutions and industry. Biopolis offers purpose-built state-of-the-art facilities and a plug-and-play environment. The Biopolis Shared Facilities and the Biological Resource Centre offer scientific facilities, services and other research resources, such as DNA sequencing and media preparation. Biopolis Phase 2 opened in

*'If you want to do research, this is a great environment; even better than the US, I would say.'*  
 Prof. Jackie Yi-Ru Ying, Executive Director, Institute of Bioengineering & Nanotechnology, and former MIT Professor on Singapore's commitment to R&D.



*'The Biopolis is not a university campus, but it's not an industrial park either; it is somewhere inbetween, and it is an arrangement that works very well. There are biotech and pharmaceutical companies here together with the government-funded biomedical research institutes. It's a very nice, self-contained environment with shared resources. The smaller companies don't have to reinvest in infrastructure—they can use what's here. But most importantly, the campus brings together people with a wonderful mix of ideas and expertise. Soon the Fusionopolis will open right next door, which will add high tech to the mix.'*

*Dr Lawrence W. Stanton, Deputy Director and Senior Group Leader, Genome Institute of Singapore, commenting on the 'one-north' concept.*

October 2006 and added another 37 000m<sup>2</sup>. The two new buildings, Neuros and Immunos, will house public research units as well as corporate R&D laboratories.

## Fusionopolis

Fusionopolis will be the epicentre of the physical science and engineering clusters, bringing together talents, expertise, organisations for innovation and breakthrough.

Fusionopolis will provide the infrastructure underpinning integration of capabilities of the SERC RIs and private R&D companies. This will allow companies to tap into cross-disciplinary expertise and sophisticated shared facilities to develop next generation products and processes.

### SERC and its Research Institutes at Fusionopolis

#### Science and Engineering Research Council (SERC)

Promotes public sector research and development in science and engineering with a focus on fields essential to Singapore's manufacturing industry.

#### Institute for Infocomm Research (I<sup>2</sup>R)

Develops holistic solutions across the Information and Communications Technology (ICT) value chain.  
 Expertise includes: mobile and wireless comms, networking, media, IT, optical comms, fibre sensors, security, decision systems and applications.

#### Institute of High Performance Computing (IHPC)

Develops and promotes the application of high performance computing technologies,

and undertakes upstream and use-inspired research.  
 Expertise includes: computational science for modelling, simulation and visualisation.

#### Data Storage Institute (DSI)

Develops innovative technologies and solutions in data storage technologies.  
 Expertise includes: magnetic head materials and design, microsystems and nanosystems for data storage, signal processing for data storage and communications, tribology and tribochemistry, laser nanoprocessing and network storage.


#### Institute of Materials Research and Engineering (IMRE)

Undertakes research in selected fields of materials science and engineering such as optoelectronics, nanomaterials, chemicals and polymers.







 Expertise includes: polymer science and chemistry, advanced materials characterisation, performance materials, nanoparticles, macromolecular chemistry and surface science.

**Institute of Microelectronics (IME)**

Helps to drive the continued growth of Singapore's electronics industries through high calibre research and development in semiconductor-based technology and solutions.

Expertise includes: integrated circuits & systems, semiconductor process technologies, microsystems, modules & components and bio-electronics.

**Singapore Institute of Manufacturing Technology (SIMTech)**

SIMTech is committed to

enhancing the competitiveness of Singapore's industries through the generation and application of advanced manufacturing technology. Expertise includes: advanced forming and joining technology, machining technology, mechatronics, precision measurement, advanced automation and product design and development.

**Institute of Chemical & Engineering Sciences (ICES)**

ICES spearheads R&D in Singapore's fast expanding chemical industry. Expertise includes: applied catalysis, particle and interface science and technology, new synthesis techniques and applications, and process technology (control & characterisation).

## Facilities available at Fusionopolis:

### Fusionopolis Phase 1

- Business and research space
- Platform for test-bedding new technologies
- Direct satellite access (uplink and downlink for media companies)
- Seamless broadband connectivity
- A\*STAR facilities (A\*STAR Compute Resource Centre, Anechoic chamber, Advanced Visualisation Centre, Network Storage Lab).

### Fusionopolis Phase 2A Features

- R&D foundry
- Centralised multi-disciplinary clean rooms (CMOS, Spintronics, Polymer, III-VI, Ceramics)
- SERC Nanofabrication and Characterisation (SNFC) facility
- Alternative energy testbed.

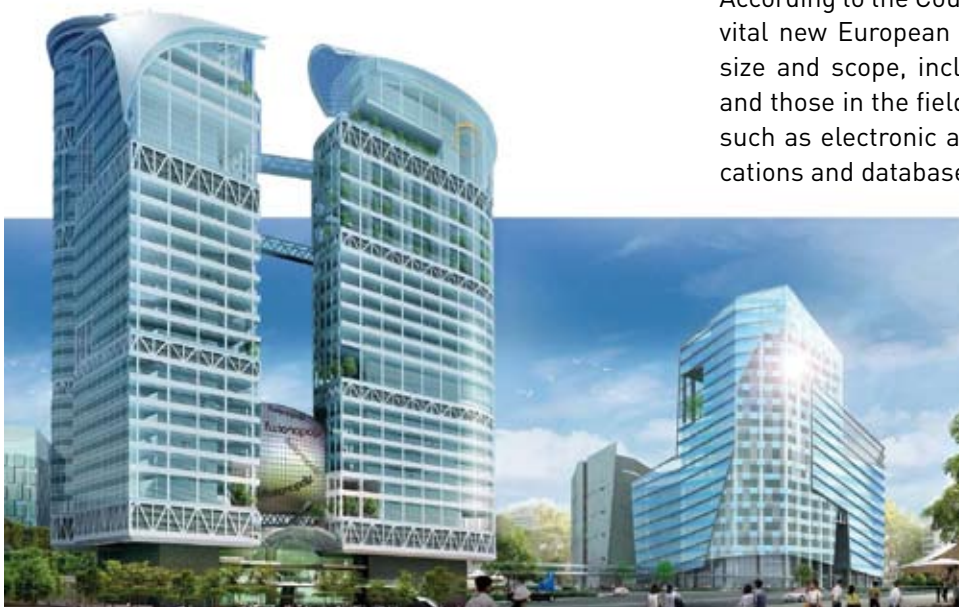
## European Strategy Forum on Research Infrastructures

In order to promote the development of key research facilities of European interest, the Council of the European Union welcomes the development of a strategic roadmap for Europe in the field of research infrastructures, and the role of the European Strategy Forum for Research Infrastructures (ESFRI).

This roadmap describes the scientific needs for research infrastructures for the next 10 to 20 years, on the basis of a methodology recognised by all stakeholders. It takes into account input from relevant intergovernmental research organisations as well as the industrial community. According to the Council mandate, this roadmap identifies vital new European research infrastructures of different size and scope, including medium-sized infrastructures and those in the fields of humanities and bio-informatics, such as electronic archiving systems for scientific publications and databases.

Corporate R&D labs, such as Vestas Technology, will be colocated at Fusionopolis to leverage on research capabilities and common infrastructure.

Fusionopolis Phase 1 will be the icon for the Infocomms and Media (ICM) cluster, and comprises a two-tower complex integrated with work-live service apartments, amenity clubhouse, technology showcase, media studio and retail outlets. It is slated for completion by early 2008. Phase 2A will bring together the complementary capabilities in materials and devices, nanoscale technology and manufacturing technology, to establish integrated capabilities in the physical sciences and engineering, and is expected to reach completion by 2009.



*'We emphasise human capital. We invest a lot in our students and their education at top universities in Europe. The mobility of our researchers and collaborative research in Europe is also very important to us.'*

**Prof. Kin Mun Lye, Deputy Executive Director for Industry, Institute for Infocomm Research (I2R)**





## Singapore's Previous Successes in the Framework Programmes

### A history of cooperation, a future of discovery

#### TEIN2 - linking Singapore and the EU

One of the enormous advantages of today's information age is the ability to engage in meaningful exchange and cooperation with colleagues thousands of kilometres away. Making the most of modern communication tools, such as video-conferencing and visual communication, however, depends on secure, reliable fibre optic computing networks. The TEIN2 project provides the critical link between European and Asian grids, making research collaboration as easy as turning on a computer. For more information, log onto: [www.tein2.net](http://www.tein2.net)

#### GAPFILL - Asia's stepping stone to FP6

GAPFILL was an IST-focused project aimed at getting more Asian partners involved in EU-funded projects. GAPFILL was a shining success, raising awareness of the Framework Programmes focusing on four Asian countries, with Singapore at the top of the list. GAPFILL has resulted in durable strategic partnerships between the EU and the region.

#### PASARELAS - a stakeholder dialogue

Singapore's newly created National Research Foundation has made environmental technologies a cornerstone of its long-term R&D strategy. Singapore participated in the FP6 PASARELAS project, which aimed at maximising research impact through the development of stakeholder dialogue 'interfaces' between science and society in coastal zones. PASARELAS is designed to run in parallel with several different EU-funded international cooperation projects, making the scientific research projects all the more relevant to the local communities affected.

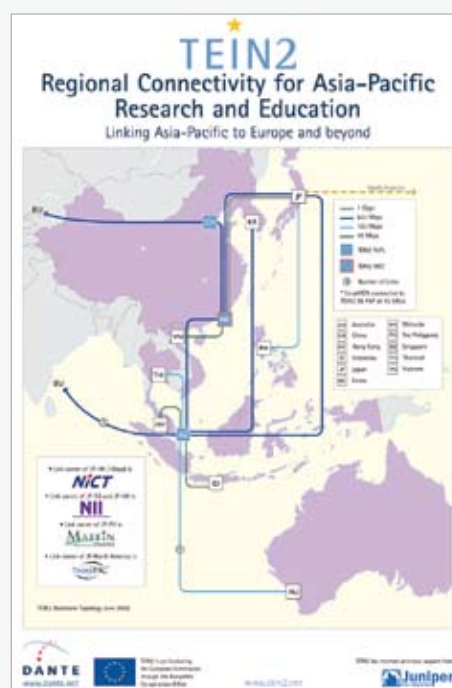
#### CRESCENDO - world-class life science research

Life sciences will also dominate Singapore's research landscape for years to come, as exemplified by the CRESCENDO project. CRESCENDO is a large-scale project seeking to turn our understanding of the human genome into innovative therapies. Specifically, it is investigating the role of nuclear receptors in ageing and development. Singapore is represented in the project by the world-class Genome Institute of Singapore.

<http://www.crescendoip.org/>

*'TEIN2 opens up the region to Europe for collaboration with direct high speed links. Pre-TEIN2, to communicate with Europe we had to go through the US, incurring high network delay.'*

*Dr Francis Bu-Sung Lee,  
SingAREN/TEIN2  
Coordinator & Associate Chair (Research), NTU*





## EU Member States and FP7-Associated Countries

### A sample of Bilateral Cooperation initiatives

In addition to European-level efforts to spur S&T cooperation with Singapore, headed by the EC's Delegation there ([www.delsgp.cec.eu.int](http://www.delsgp.cec.eu.int)), individual Member States and FP7-associated states, such as Switzerland and Norway, have taken note of Singapore's strategic position and have forged close ties with its research community. Several embassies and government representations have permanent science and technology officers charged with maintaining a bilateral dialogue with the island city-state. A brief overview follows, of some of the R&D initiatives that countries have under way in Singapore.

#### Netherlands

The Netherlands has a well-established relationship here in terms of R&D. The Delft-Singapore Water Alliance is a perfect example. Water issues obviously pose many challenges for both the Netherlands and Singapore, so it makes sense to work together on a common problem. Our office here supports such initiatives and encourages

similar collaboration across all sectors. The European Commission has a role to play by providing up-to-date information on international collaboration possibilities and informing actors on planned activities here in Singapore.'

**Ms Annoek van den Wijngaart**  
**Science and Technology Adviser**  
[www.twanetwerk.nl](http://www.twanetwerk.nl)

#### France

France's Science and Technology officer ensures that both sides remain aware of the latest R&D developments in each individual country, as well as oversees research exchange programmes. The embassy's most recent development was the Merlion Research scholarships programme, named after Singapore's mythical mascot. The Merlion scholarships fund travel costs for researchers travelling between France and Singapore. The Merlion PhD Programme funds six PhD students who split their lab time between France and Singapore.

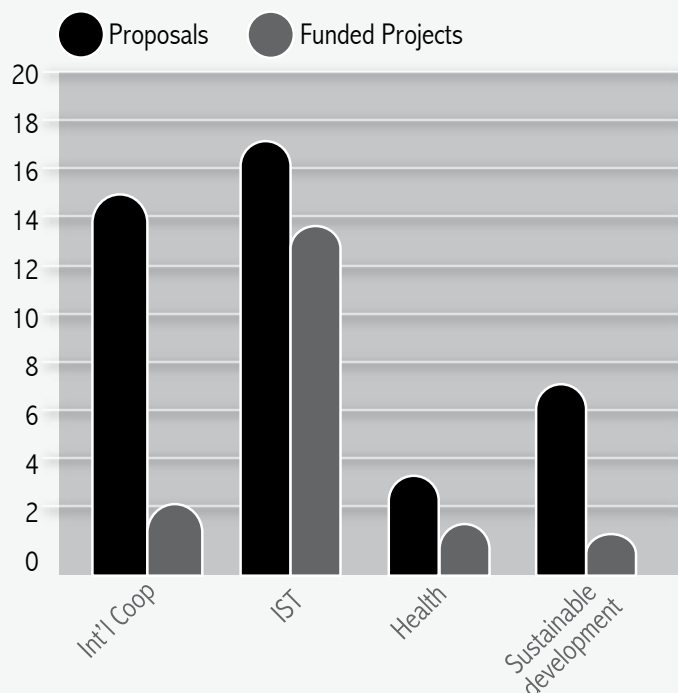
[www.ambafrance-sg.org/](http://www.ambafrance-sg.org/)

#### United Kingdom

The Science & Innovation section of the British High Commission, based at Singapore's life sciences campus, Biopolis, is part of the Foreign and Commonwealth Office's global Science & Innovation Network. Their aim is to foster scientific collaboration between the UK and Singapore.

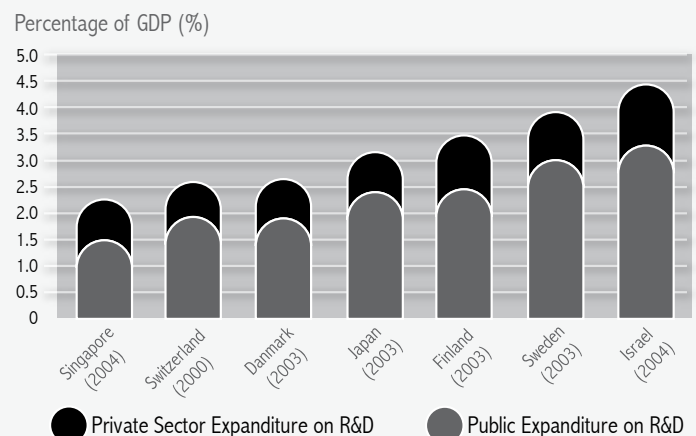
## Singapore's R&D strategy by the numbers

Singapore in the Sixth Framework Programme (FP6)



Private & Public Sector Expenditure on R&D

Source: OECD Main Science and Technology Indicators (2005)





The UK-Singapore science relationship is set out in an agreement signed by the Prime Ministers of both countries in 2005, in which they agreed to encourage scientific collaborations and networks and help build scientific capacity with South East Asian Partners. Scientific workshops have been held in many fields including neuroscience, microelectronics, chemistry, aerospace engineering and immunology. Each workshop has been followed by the award of travel grants (Collaboration Development Awards) to enable researchers from the region to visit the UK to develop collaborations. Around 100 awards have so far been made, leading to numerous collaborations.

[www.britain.org.sg](http://www.britain.org.sg)

### Switzerland

The Swiss House Singapore is a platform of the Swiss Embassy, fostering partnerships between Switzerland, Singapore and South-East Asia in the field of education, research and innovation. It operates in synergy with academic, governmental and economic networks, and provides partnering opportunities by organizing innovative events and sharing its knowledge network with its stakeholders.

'Ours is a novel initiative; we go beyond the science counsellor's responsibilities. We are actively providing a platform supporting institutions, students, professors,

researchers and entrepreneurs in their partnering activities. We cover education, research and innovation in a single initiative. Being here at Biopolis allows us to reach out to local partners as well as to help Swiss visitors in liaising, for example, with Singapore's Economic Development Board or A\*STAR located here. And that's exactly what Singapore, via Biopolis and Fusionopolis, is trying to nurture.'

**Dr Suzanne Hraba-Renevey**  
Executive Director

[www.swisshouse.org.sg/](http://www.swisshouse.org.sg/)

### Norway

Norway, a long-time leader in maritime technology, has encouraged R&D cooperation in this renowned shipping port. The Norwegian embassy in Singapore has a counsellor for science and technology to support R&D co-operation and to support the established memorandum of understanding on maritime research and development, education and training.

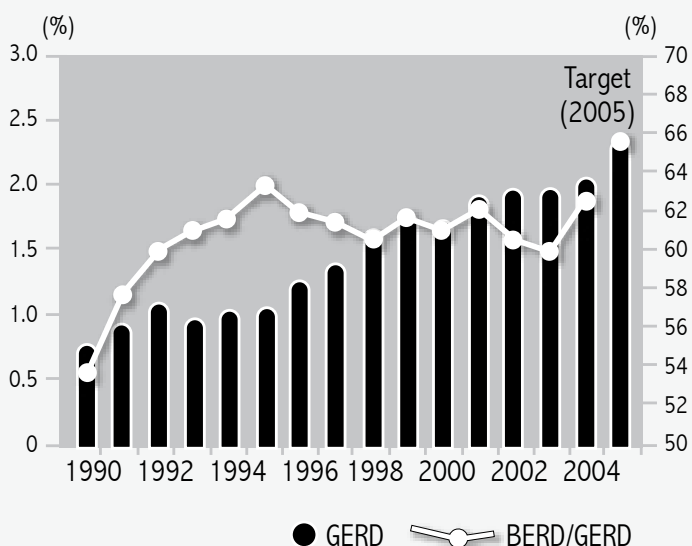
<http://www.norway.org.sg/>

### Germany

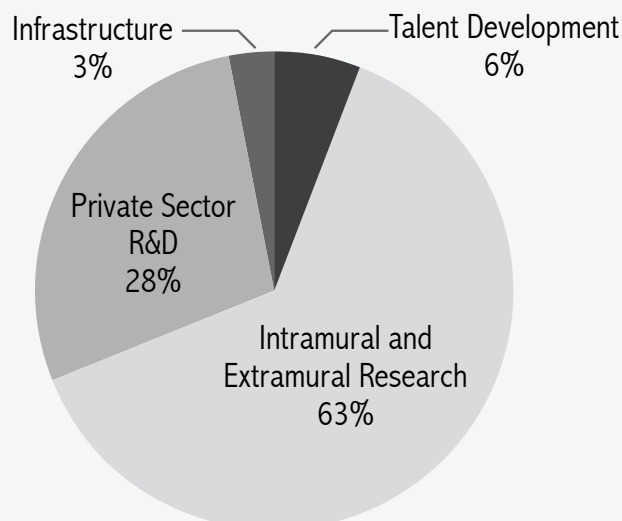
Germany's R&D activities in Singapore have increased significantly in the last few years. Close ties have been established on various levels, including two joint projects on an institutional basis, the GIST (German Institute of

GERD/GDP growth and Private sector share of GERD  
Source: National Survey of R&D in Singapore (2004)

GDP: Gross Domestic Product  
GERD: Gross Expenditure on Research & Development  
BERD: Business Expenditure on Research & Development



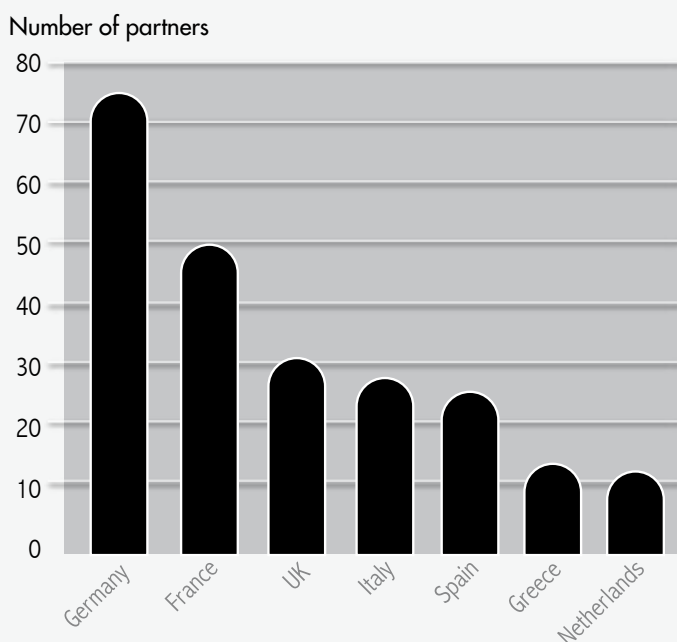
Breakdown of S&T 2010 Budget  
(Total: SGD 13.55 million)





Science and Technology), an initiative of the Technical University of Munich (TMU) with the National University of Singapore (NUS) and Nanyang Technological University (NTU), and the CamTech (Center for Advanced Media Technology), a joint R&D centre between the Fraunhofer Institute for Computer Graphics (IGD) of Darmstadt and the NTU. Additionally, there are more than 20 ongoing scientific partnerships between research institutes, universities and institutions of higher education in the fields of optical technologies, ICT and advanced media technologies. Shared academic programmes range from natural and medical sciences to humanities, in addition to automotive engineering. German companies in Singapore have also significantly expanded their R&D capacities in recent years.

Singapore's partners in FP6 research consortia





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The European Union's Seventh Framework Programme for Research and Technological Development, FP7, is Europe's principal instrument for funding scientific excellence. The funding appropriated for FP7 is channelled to a number of dedicated initiatives designed and developed to contribute to the European Research Area (ERA), the EU's single market for research and innovation. European decision-makers have realised early, however, that for the ERA to be most effective, its scope must not be limited to Europe's physical or political frontiers. Singapore has made impressive strides in becoming an international hub for research; and this coupled with its location in the heart of the ASEAN region with a huge growth potential make it an ideal partner for Europe in its drive towards research excellence. This brochure will serve as a way to highlight those areas where Europe's and Singapore's respective R&D strategies are complementary, as well as a guide to finding practical information on cooperation opportunities.

<http://ec.europa.eu/research/fp7>  
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