



# ETM Internal Report

**R&D in Science & Engineering  
For Singapore's Economic Development: Strategies and Key  
Results**

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**Division of Engineering & Technology Management (D-ETM)  
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**R&D in Science & Engineering**  
**For Singapore's Economic Development : Strategies and Key Results**

**by**

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## **Background**

For a small, newly developed nation like Singapore, the willingness and ability to regularly reinvent itself, especially in its economic development are essential. Former economic practices which worked very well for Singapore may have to be modified and a new direction adopted to keep up with fast changing times. Recently Singapore is working very hard at becoming a knowledge-based economy. The rapid rise of China and India presents both challenges and opportunities. It is clear that Singapore needs to accelerate its transformation to a knowledge-based economy. There is also one important point which needs to be clarified at the outset: there has been a wrong perception by some people that a knowledge-based economy refers to a pure service-oriented economy. In fact, a knowledge-based economy could embrace manufacturing: knowledge-intensive manufacturing with concurrent design and research/development (R&D) activities.

To thrive in a knowledge-based economy which includes strong manufacturing, Singapore needs to have a significant pool of high-level scientific/engineering manpower and necessary infrastructure support. In order to build the foundation to reach this goal in the 21<sup>st</sup> century, the far-sighted Singapore Government has invested substantially in research since the early 90s. There was indeed little need to invest in R&D in the past until the late 80s as the majority of industrial companies in Singapore were multinational companies (MNCs) which successfully transferred advanced technologies to their Singapore operations and to their key local components and service suppliers. Singapore was then sailing on chartered waters and the correct course could be based on experience culled from other parts of the world. However, the Government anticipated that continued economic success would eventually propel Singapore into uncharted waters in the next decade where competition would be much more acute and past experiences might be less relevant. Extensive innovation and research would then be necessary. As research would need many years to build depth and yield tangible outcomes, the Singapore Government made a bold decision to establish the National Science and Technology Board (NSTB) ahead of time in

January 1991 to nurture science and technology advancement in Singapore. In January 2002, the NSTB was renamed A\*STAR, an abbreviation for Agency for Science, Technology and Research. The explicit inclusion of “research” in the new name underscores the importance of research for Singapore’s future. In 2005, the Government announced the formation of a new Research, Innovation and Enterprise Council chaired by the Prime Minister. Among the various strategic targets, the most prominent is the one which would see the national R&D expenditure substantially increased from 2.36% of GDP in 2005 to 3.00% by 2010. A new National Research Foundation (NRF) has also been established by the Council to boost research in universities and nurture new strategic areas of economic development.

Over the last 17 years, NSTB/A\*STAR has established 14 public, mission-oriented research institutes with about 2200 research scientists and engineers. Seven of these institutes perform research in biomedical sciences and this would pre-position Singapore for future opportunities in this emerging field. The other seven research institutes are in areas relevant to Singapore’s existing major industries, which include electronics, infocomms, chemicals and general engineering. In recent months, the NRF (and Ministry of Education) announced a new major funding scheme for a number of world-class Research Centres of Excellence (RCE) to be established. They will be headed by eminent scientific leaders and will conduct investigator-led research with a global impact. With the hope of winning separate competitive programme fundings from the NRF, the National University of Singapore has also committed resources to establish strategic, basic research institutes which are different from the A\*STAR research institutes and the RCE (to be elaborated in a later section).

How rapid and how successful could Singapore achieve in its knowledge-based economic development would depend significantly on the availability and quality of its Research Scientists and Engineers. In high-tech R&D, it is increasingly common to have both scientists and engineers working together as a team. We shall therefore not differentiate the roles of these research scientists and engineers, and refer to them as Research Scientists and Engineers (RSEs) or

simply researchers. It is the innovative researchers who would create a competitive advantage for the companies [1]. They will also significantly enhance the human intellectual capital of the nation [2]. In the uncharted waterways of high-tech development, innovative researchers will help find new directions to steer the companies to their destinations and create a future for all. It is therefore imperative for Singapore to invest heavily in the accelerated development of experienced researchers and also to encourage and help its brightest students to become researchers.

### **Meeting Industry's Needs**

So what does a knowledge-based industry need?

With their continuing growth towards further globalization, more multinational companies (MNCs) are setting up research and development (R&D) centres outside of their home bases. In order to remain relevant to these MNCs, Singapore has adopted the strategy of supporting both the advanced manufacturing and R&D centres to be hosted in Singapore. This has already been achieved by some local establishments of MNCs which have won worldwide product charters that allow them to make major decisions including R&D in Singapore. Having R&D and pilot production together has produced a competitive advantage of shorter time to mass-manufacture and market. There are essentially two types of foreign R&D sites [3]: the “home-base-augmenting” site to tap knowledge from competitors and universities around the globe, and the “home-base-exploiting” site to adapt standard products to local and regional demands. Both types of R&D sites are welcomed by Singapore to further promote and reinforce the long-term partnership of MNCs with local institutions. The mission-oriented A\*STAR RIs have been proactive to support the local R&D needs of MNCs in the form of joint R&D and also in their access to specialized equipment and expertise in the RIs.

In order to attract and root the high-value added operations of MNCs in Singapore, it is also increasingly critical to ensure that its supporting industries have developed attractive indigenous capabilities. Up to the early 2000's, MNCs

would look for reliable supporting industries, which were typically local, small and medium enterprises (SMEs), and then transferred the needed technologies to them. The scenario has since changed quite rapidly. As MNCs needed to market their products more quickly and to keep up with rapidly changing technologies, they would no longer be willing to wait, to transfer the needed technologies, and to continually train the SMEs. They would instead go to a country where they could source their components or processing needs from local SMEs which already have relevant technologies. This trend has gained more momentum as the global manufacturing outsourcing practice in recent years has resulted in much reduced in-house manufacturing expertise in many of the MNCs themselves. Finally the presence of strong SMEs would make it easier for MNCs to locate their home-base-exploiting R&D sites in these foreign countries. The available R&D manpower, knowledge and other technological structure may even attract SMEs from other developed nations to set up subsidiaries in Singapore as they too will need to globalize their business operations.

The specific needs of MNCs discussed above are also largely relevant to the smaller number of local manufacturing companies, some of which have also become MNCs albeit on a smaller scale. Their positions would be strengthened if they could use research institutes and universities in Singapore to satisfy their technological needs, similar to what their competitor MNCs could gain from their home countries. The research institutes (RIs) under A\*STAR have indeed been challenged to develop world-class capabilities which can be used to enhance the competitiveness of the MNCs and local companies and they have responded very well.

The A\*STAR research institutes have been created to focus on strategic areas of economic growth. They attract both local and foreign talent as they enhance their reputation as world-class R&D institutions. Subsequently, their experienced staff have been head-hunted from time to time by new R&D and design centers set up by industry. As one of its national contributions, the research institutes have indeed planned to "lose" researchers regularly to industry so that such talent can

contribute more directly to industry. A healthy flow of "human transfer" is thereby created. Since they need to maintain a critical mass of experts, research institutes will continue to replenish their talent pool by aggressively recruiting both locally and worldwide. Since 2003, this "manpower sharing" function geared specially for the local enterprises has been formalized under the A\*STAR GET-Up (Growing Enterprise through Technology Upgrade) scheme [4].

There are already some 20,000 researchers in Singapore, after rapid growth over the last 17 years. This growth trend is expected to continue at least for another 5 years till 2012 hence creating a great demand for Singaporean researchers and R&D talent from the region, especially China and India. In addition to the needs of A\*STAR research institutes and industry, a new demand for R&D manpower will come from the universities and new basic research institutes/centres performing large scale, longer-term research upstream of the A\*STAR research institutes and in new emerging areas which have potentials for economic/industry development.

### **Key Research Institutes/Centres**

Being a small country, Singapore cannot afford to invest its finite R&D resources, especially its human capital, in too many and diverse areas. It has therefore carefully planned to focus on areas relevant to industry clusters that have the highest chance of developing world-class capabilities.

As the biomedical science sector is new and still emerging, this section will only address in more details the non-biomedical science areas which have been identified by the Science & Engineering Research Council (SERC) of A\*STAR. The areas are grouped under 4 industry clusters which have become Singapore's focus : Electronics, Infocomm, Chemicals and Engineering. In fact, all the 7 A\*STAR research institutes under SERC are in these sectors. In each cluster, sub-clusters have also been identified, as indicated in Figure 1. These Research Institutes have developed capabilities and research programmes to address the challenges in selected areas under each sub-cluster. Some of the

major technology areas are indicated in Figure 2 and Figure 3. Some of their significant research achievements in recent years are outlined in Tables 1 to 3 [5]. Likewise, the academic departments of the two major local universities (National University of Singapore and Nanyang Technological University) are developing capabilities and research programmes upstream of the needs of the A\*STAR Research Institutes. The universities are of course not limited to these focussed areas. As their roles include exploring potential areas of future importance, the universities also do research selectively in emerging areas such as environmental science and engineering, engineering systems and biomedical engineering.

The private sector has focussed R&D activities which are tied to their manufacturing and business operations. According to a recent survey results by A\*STAR [6], the private sector's share of R&D expenditure was 66% in 2005. It also employed more than 13,200 researchers in 2004. Companies in the Electronics and Precision Engineering sectors continued to account for the bulk of the private sector R&D expenditure. Overall, the survey showed 900 companies performing R&D in 2005. In terms of attracting MNCs to establish R&D centres in Singapore, the Economic Development Board succeeded in securing US\$5.6 billion in total R&D investment from 2001 to 2005, and creating more than 6,400 RSE positions [7]. Such R&D activities have helped to anchor associated high-end manufacturing projects, and seed new growth within various industry sectors.

An example of a huge industrial R&D centre in Singapore is the Philips Innovation Campus. With over 1200 design and development engineers, it is the largest product development centre of Philips outside its headquarters in the Netherlands. Since 2000, more than US\$210 M investments have been committed in this Singapore campus. It has now generated US\$5 billion in annual sales for Philips globally. During 2005, more than 1000 new products were developed in this campus. The areas of focus are display systems, home entertainment systems, semiconductor connectivity, remote controls, radio frequency controls, optical storage, etc.

Another example is the Singapore R&D Centre of Seagate Technology. It now hires about 220 R&D engineers. In 2000, these engineers in Singapore were responsible for conceiving and developing the U series high-capacity disk drive with just two platters and a record-breaking areal density of 32.6 Gbytes per sq. inch. It utilized state-of-the-art fluid dynamic bearing motors to achieve idle acoustics of 27 decibels, the lowest in industry. These and other innovations led to the filing of more than 40 worldwide patents and enabled the products to rapidly penetrate markets in high-volume PCs, video recorders, game consoles and other consumer devices. The U series has become Seagate's biggest selling product in its entire history. In 2004, the Seagate R&D Centre scored again with the new ST1 Series 1-inch drive which was completely conceived and developed in Singapore. In parallel, Seagate development engineers have been contributing to Seagate's "factory of the future" initiative with the goal of achieving high-volume production with virtually no human intervention.

A most recent example is the large software development centre of the Japanese giant in industrial process instrumentation and control, the Yokogawa Electric Corporation. This R&D Centre was set up in 2004 with more than 100 research engineers to develop advanced process control and plant resource management software for its world's leading Distributed Control System. It has an ambitious plan to grow the number of software development engineers to a size of 500 in its strategy to achieve the goal of becoming the world's No. 1 industrial automation supplier by 2010.

In addition, the national R&D effort has been boosted by the Defence Science & Technology Agency (DSTA). For instance, it oversees the DSO National Labs which has more than 600 researchers who are active in creating materials, command and control, chemical and biological defence technologies. It has also set up the Temasek Labs at the two local national universities (NUS and NTU) to do joint research with the academic researchers in emerging areas such as nanotechnologies. Some of the defence technologies have commercial potential as well and they are called dual-use technologies. It is well-known that dual-use

technologies have enhanced the national competitiveness of US, UK, Sweden, Israel, etc. It is thus expected that Singapore's high-tech industry development would be influenced likewise in due course.

Finally, upstream of industry, A\*STAR research institutes and DSO National Labs, the universities have started to invest heavily to establish a number of basic research institutes/centres with major funding from the National Research Foundation (NRF) to deepen Singapore's science and engineering foundation and build long-term capabilities and competitive advantages for Singapore's knowledge-based economy. For instance, the National University of Singapore (NUS) has just established the first Ministry of Education and NRF co-funded Research Centre of Excellence in the field of Quantum Information Science and Technology. It will focus on basic research in quantum computing, communication and cryptography which will create frontier knowledge and train researchers upstream of A\*STAR research institutes and industry. NUS has also announced a long-term plan to nurture two large-scale basic research institutes to perform interdisciplinary research of strategic relevance to the future economic development of Singapore and to train PhD level researchers ahead of industry demand. One of them is the NUS Environmental Research Institute (NERI) which will pioneer research in water, air quality, energy, sensing, security and policy issues which are critical to the future positioning of Singapore as a world-renowned centre for environmental science, technology and innovation. The other is the Interactive and Digital Media (IDM) Institute which will undertake leading-edge, application inspired basic research in Mixed Reality, Games, Social Robotics, Ambient Intelligence, Multimedia Sensing, etc which are relevant to the emerging needs of Singapore's new media industry and its accelerated growth.

### **Additional Strategy Options**

The proactive and extensive public R&D investments over the last 17 years have helped Singapore to nurture R&D talent, attract both young and experienced RSEs from Asia and many other parts of the world to develop R&D careers in

Singapore and enhance Singapore's reputation as a global hub for high-tech R&D. The ease of assembling a new R&D team consisting of Singaporeans (who are multi-racial themselves), Chinese, Indians and other non-Asians in Singapore has created a unique competitive advantage in cultural diversity well appreciated in creative team formation. The ready availability of local/global R&D talent, coupled with the well developed Intellectual Property protection practice [8], superior logistics, global life-style, R&D collaboration with universities/RIs, and other infrastructure and financial advantages has enabled multinational companies to rapidly and successfully establish new R&D centres/programmes in Singapore. An increasing number of local companies have also invested in R&D for new product creations and process improvements to stay competitive and to expand their global businesses. Under the A\*STAR GET-Up scheme, these local high-tech enterprises could receive additional assistance from the Research Institutes in three ways: secondment of RI researchers to companies for 2 years, operational and technology roadmapping service, and attachment of senior managers from RIs. Since 2003, more than 190 local enterprises have benefited from the GET-Up scheme (with 135 RSEs seconded to companies, 90 roadmaps developed and 54 technical advisors appointed). Over the years, the growth of R&D investments by industry has indeed matched those of the public sector and helped to maintain the target private/public sector ratio of around 65/35. The impressive figure of 90.1 RSE per 10,000 labour force in 2005, and the continuing increase of RSEs with PhD degrees being employed in the private sector, further demonstrate success in achieving R&D intensity and sophistication.

The broad strategies of the Singapore Government in R&D have been in proactively investing in the critical human capital creation and in pro-industry policies and infrastructure development. It regularly consults industry, especially the MNCs, on their future needs and responds promptly once it detects a major trend of new capabilities/technologies needed. It will assist the local universities and ensure that the A\*STAR research institutes develop capabilities in such emerging areas and transfer both trained manpower and technologies to the local high-tech companies and key supporting industry companies. Where

relevant, the Government will invest in infrastructure such as the Fusionopolis which is being developed as the focal point for the Infocomm cluster as well as the physical sciences and engineering. By housing both public and private research organizations in the same location, the Fusionopolis hopes to create synergy and become a cradle for knowledge convergence, where next generation applications are incubated and test-bedded.

To date, the Singapore Government has provided effective support to the private sector companies (both MNCs and local) to implement their R&D plans. As described clearly by Prof Clayton Christensen [9], the incumbent companies have to listen, in turn, to the needs of their key customers and focus on R&D to sustain/expand their existing markets. The type of R&D performed by the MNCs is thus largely for sustaining/expanding the existing market shares. Furthermore, although some MNCs would perform radical R&D and high-end technology development to leapfrog their global competitors in the existing market or to create completely new markets, they would perform the upstream R&D only in their home countries in their corporate research labs. The type of R&D performed by MNCs in Singapore and their other overseas R&D centres is therefore usually confined to incremental R&D for sustaining innovation. This explains why the MNCs do not need to tap the patents and IPs created by local universities and RIs as they could rely on their parent company's core IPs to make incremental improvement. Prof Christensen also identified disruptive innovation [10] which is favoured by new entrants, but also being increasingly pursued by incumbents which have learnt the importance of such a strategy for new market creation and how to implement it successfully. As this type of R&D is just emerging in the advanced economy, it has not yet filtered down to a remote site like Singapore. In view of the above analysis, there are indeed gaps and thus opportunities for Singapore to consider as additional future strategy options. They are outlined in the following discussion.

In radical (high-end and long-term) R&D and innovation [11], which requires very substantial financial and manpower resources and extremely long time commitment (typically 5 to 10 years), a small nation like Singapore could only

choose a few areas to make any impactful contributions. By the nature of conventional academic research, the type of research favoured and performed at universities is also the radical type. As mentioned earlier, NUS has already launched a Research Centre for Excellence (RCE) in Quantum Information Science & Technology with a S\$150 M budget for its first 5 years of operation and a target of recruiting 200 RSEs. For such a substantial investment in each RCE, it is anticipated that the nation will identify both the downstream A\*STAR research institutes and the MNC partners in due course to better coordinate the overall national effort. In the biomedical sciences area, the Biomedical Research Council (BMRC) has done this step as soon as its first basic research institute, the Institute of Molecular and Cell Biology, has established itself. It has resulted in the formation of other complementary institutes, such as the Institute for Clinical Sciences which will accelerate the translation of basic discoveries into new diagnosis and therapeutics. Another bold initiative by the National Research Foundation (NRF) is the development of a Campus for Research Excellence and Technological Enterprise (CREATE). It is envisioned as a multinational, multidisciplinary research enterprise which will host world-class research centres in areas of strategic interests to Singapore. The first to establish a research centre under CREATE is the world renowned Massachusetts Institute of Technology (MIT), which is called the Singapore-MIT Alliance for Research and Technology (SMART). When fully established, it will house five to six large research groups with about 400 faculty, post-docs, research students and other technical staff. They will collaborate with other universities, research institutes and industry in Singapore and in Asia. The NRF is in discussion with the Swiss Federal Institute of Technology and Israel's Technion Institute of Technology for them to establish a similar research presence in CREATE. In addition to academic research centres, CREATE will also house corporate research labs, which will interact with other research centres of CREATE and the local universities on leading-edge research. As more MNCs are expected to reduce their corporate R&D investment or shift some corporate R&D activities to strategic locations such as Singapore, they will depend more and more on Open Innovation [12] for which Singapore is well positioned to play a proactive role. When this happens, the IPs created in Singapore universities and RIs could

become very valuable to MNCs. It is also hoped that high-tech start-ups would also be created by the entrepreneurial researchers and graduate students stimulated by the US examples.

In disruptive R&D and innovation, which are suitable for low-end disruption or new market creation using “good enough” technologies, the potential role of universities and public research institutes was not very clear in the past as the successful examples elaborated by Prof Christensen and other academic publications did not obtain direct help from them. While it was true that the correct business model for disruptive innovation has to be figured out by the established companies or the entrepreneurial entrants themselves, the availability of suitable disruptive technologies in the past was largely by chance. If a nation or if any company wants to create disruptive products/innovations more frequently, it could not simply wait for the next chance; purposeful creations of disruptive technologies by means of R&D would be needed. How this goal may be achieved and whether universities and public research institutes could play this role are emerging research topics in innovation management. For instance, the simplification of certain radical technologies and their further reshaping could produce useful disruptive technologies [10]. Other methods of purposeful creation of disruptive technologies through R&D have recently been proposed in the literature [13].

The emerging strategy of developing new products targeting Asia and other less developed markets [14], rather than the traditional lead-user markets in US and Europe, to capitalize on the new opportunities created by the huge and new middle-class consumers, could also draw significantly from research findings in disruptive innovation. If a nation such as Singapore could achieve this goal of creating disruptive technologies more frequently and regularly, it could attract more MNCs and foreign entrepreneurs to seek partnership to create more innovative products and innovation ahead of other competitors, hence achieving continuous business growth which all aspire to achieve. Following Christensen’s argument, start-ups based on such disruptive technologies/ innovation would have a much better chance of success when compared to those based on radical

or sustaining technologies/innovation. Finally, it should be mentioned that the interpretation of the term “disruptive innovation” has nowadays been broadened to encompass its powerful role in creating new markets and reaching out to new customers, with or without the final outcome of disrupting the incumbents.

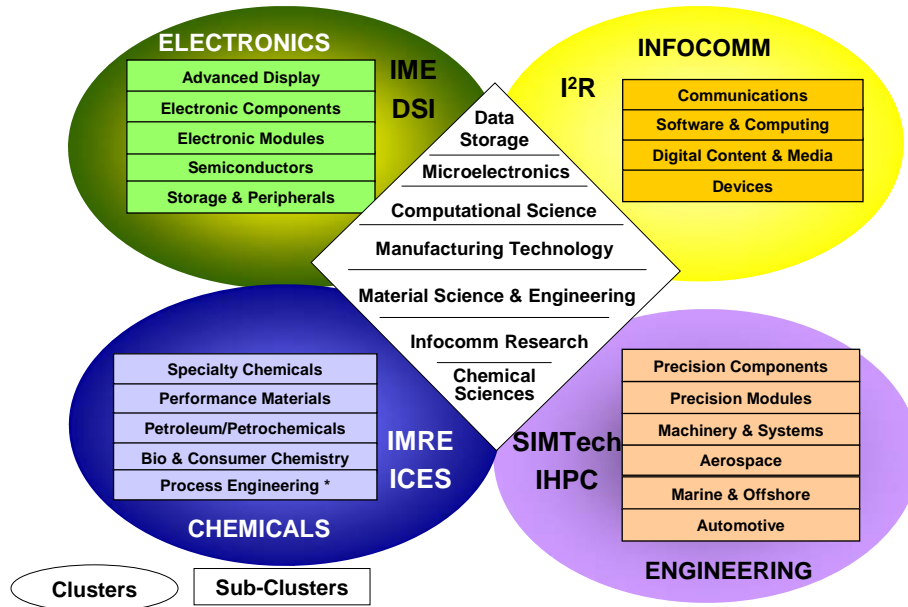
### **Concluding Remarks**

In this paper, we have reviewed the strategies adopted by Singapore in promoting its economic development through investing in R&D in science and engineering. Key results in terms of establishing the reputation of Singapore as an attractive venue for high-tech R&D and the continuing growth of R&D activities in the private sector companies (both MNCs and local enterprises) have been highlighted. The critical role of universities and research institutes especially in attracting and nurturing both foreign and local R&D talent has been elaborated. The key technology areas selected in consultation with industry have been outlined. We have ended the paper by a brief discussion on additional future strategy options for economic development, both radical R&D/innovation and disruptive R&D/innovation which may be promoted in Singapore and the possible role which may be performed by universities and public research institutes.

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## SERC-Related Industry Clusters



**Figure 1**

## A\*STAR/SERC Research Institutes (RIs)

### Data Storage Institute (DSI)

- Magnetic technologies
- Optical technologies
- Network storage technologies



### Institute for Chemical and Engineering Sciences (ICES)

- New synthetic techniques & applications
- Applied catalysis
- Crystallization & interface science & technology



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

- Media
- Comms & Devices
- Services & Applications



### Institute of Microelectronics (IME)

- Integrated Circuits & Systems
- Microsystems Modules & Components
- Semiconductor Processing Technologies

**Figure 2**

## A\*STAR/SERC Research Institutes (RIs)

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

- Molecular & Performance Materials
- Micro & Nano, Opto & Electronics Systems
- Materials Science & Characterisation



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

- Computational Mechanics (Solid + Fluid)
- Computational Chemistry & Electronic Systems
- Advanced Computing Technologies



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

- Process Technologies
- Enabling Technologies
- Industrial Informatics



**Figure 3**

### **Table 1 : Significant Achievements of the Institute of Microelectronics**

- Established a world's leading centre for design, fabrication, ASICs and packaging of MEMS devices. MEMS products developed include silicon pressure sensor, micro-accelerometer, silicon microphone, micro-relay and micro-PCR.
- Developed a silicon wafer bonding technology in stack wafers for the first truly integrated 3-D packaging in the world.
- Established Silicon photonics program leveraging on IME's capabilities in CMOS, MEMS, optical interconnect, and photonics packaging; Identified high-speed transceiver and board-level optical interconnect as the driving theme; Developed strategic partnership with Chartered to create and bring Si photonics industry to Singapore.
- Demonstrated Gate All Around CNOS transistors with ultra thin body (3nm) Si nano wires with extremely high drive current. Results were presented in International Electron Device Meeting (IEDM) and were selected for publicizing 2006 IEDM to help build its long-term visibility and recognition.
- Demonstrated world's first a highly integrated low-cost 0.18um RF CMOS reader IC that enables low cost UHF (Ultra High Frequency) RFID reader/writer modules.
- Demonstrated optical link on Optoelectronic PCBs and developed miniaturized planar optical DMUX for multi-channel CWDM Transceiver.
- Developed and demonstrated a CMOS-compatible Si nanowire arrays for label-free bio-sensing applications with multiplexed detection capabilities. DNA concentration down to 10fM has been achieved, comparable to best reported sensitivity using less manufacturing technology.

## **Table 2 : Significant Achievements of the Data storage Institute**

- Successfully obtained a GMR ratio of 44.6% (approaching world record: 49.7%) in magnetic tunnel junction.
- Developed antiferro-coupled media and high-oriented media, and transferred technology to company.
- Developed 4.7-GB DVD-RAM phase change media with 8 companies and training manpower.
- Developed DVD-CD-R optical pickup heads with company (company subsequently set-up activities in Singapore).
- Developed a patented world-first pulse laser irradiation technology for contamination-free cleaning of hard disk drive media.
- First to develop 20k rpm ferro-fluid spindle motor for HDD applications.
- Developed advanced micro spindle motor technology that won the NTA 2006 award.
- Set up media training, R&D RCAs to support diskmedia industry expansion (Seagate, Showa Denko, Hoya).
- Developed low temperature ( 300 oC) FePt media and PMR media technology fabrication processes.
- Developed 45 nm superlattice-like PCRAM and won EPCOS best paper award.
- Achieved the first picosecond electric pulse phase change in PCRAM.

**Table 3 : Significant Achievements of the Singapore Institute of Manufacturing Technology (SIMTech)**

- CAD/CAM and PDM software development with some of the biggest players in the world (UGS, Autodesk, etc). Software developed in Singapore (IPR in Singapore) and used worldwide.
- 2D to 3D migration programme for Precision Engineering industry (250 companies: 500 RSEs trained).
- Developed process for semisolid forming of Ti together with NIRIM (Japan) (Applied in AMT).
- Developed intelligent moulding control system for plastic parts (with Cornell U.) and applied at Philips DAP.
- Developed an automatic intelligent inspection system (using ultra-sonic & eddy currents) on aircraft wing for ST Aerospace.
- Developed a high-accuracy, low-cost digital level with Leica Instruments Singapore. The development was a contributing factor in Leica's decision to carve out Leica Geosystems Business from Leica Instruments Singapore and setup a new manufacturing plant and world wide headquarter for leveling and alignment in Singapore.
- SIMTech, with support from A\*STAR, EDB, SPRING, and IDA, launched the National RFID Centre in 2006 to spearhead the adoption of RFID Technology in the local industry.
- In support of the Aerospace Programme, SIMTech has successfully brought together 4 major aerospace OEMs (Boeing, EADS, Pratt & Whitney and Rolls-Royce) to carry out basic-directed and applied research in several key research areas.