

High-tech Future

The Ministry of Science and Technology's 60th anniversary celebration highlights Taiwan's progress in engineering a technology-driven economic transformation.

BY PAT GAO

PHOTOS COURTESY OF MINISTRY OF SCIENCE AND TECHNOLOGY



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In August, Vice President Chen Chien-jen (陳建仁) visited the Taipei City headquarters of the Ministry of Science and Technology (MOST) to participate in its 60th anniversary celebration. Established in 1959 as the National Council on Science Development, the organization was upgraded in 1967 to the National Science Council, which Chen headed from January 2006 to May 2008, before restructuring in 2014 to take on its current form.

An epidemiologist by trade, Chen holds the prestigious lifetime academician title from Academia Sinica, the nation's foremost scientific institution. For a country short on natural resources like Taiwan, he said, the only one it can truly call its own is brain power—the energy spurring science and technology R&D.

According to Chen, one of the brightest accomplishments of the MOST is the establishment of Hsinchu Science Park (HSP) in 1980 in the northern Taiwan city; Southern Taiwan Science Park (STSP) in 2003 in Tainan and Kaohsiung cities; and Central Taiwan Science Park in 2007 in Taichung City. Last year, Chen said,

the three epicenters of a high-tech industrial boom employed around 270,000 and produced a record total revenue of more than NT\$2.6 trillion (US\$83.87 billion), rising from less than NT\$2 trillion (US\$64.52 billion) when he helmed the organization.

New Heights

The launch of Formosat-7, a group of six satellites jointly developed by Taiwan and the U.S., June 25 from Kennedy Space Center in Florida, is another high point for Chen. The



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01. A depiction of the Formosat-3 satellite, Taiwan's meteorology observation constellation
02. Vice President Chen Chien-jen, center, and Minister of Science and Technology Chen Liang-gee, left, participate in the 60th anniversary celebration of the Ministry of Science and Technology in Taipei City.
03. Formosat-5 is launched in August 2017 from Vandenberg Air Force Base in California.

01 & 03. Courtesy of National Space Organization, National Applied Research Laboratories



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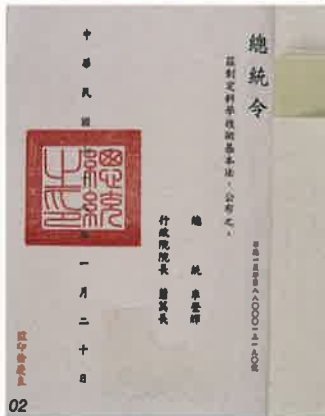
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advanced climate monitoring satellite constellation follows in the footprints of Formosat-1, Taiwan's first satellite launched in 1999.

In Taiwan, the satellite program is conducted by HSP-based National Space Organization (NSPO). Its preparatory office opened in 1991 as part of the Long-term National Space Technology Developmental Plan initiated that year. The NSPO operates as one of eight institutes administered by the National Applied Research Laboratories (NARL), formed in 2003 under the MOST. Also located at HSP are the NARL's National Center for High-performance Computing, Taiwan Instrument Research Institute and Taiwan Semiconductor Research Institute, while the other four specialize in the areas of earthquake

engineering, animal testing, ocean studies and science policy research, respectively.

MOST Minister Chen Liang-gee (陳良基) said all of the facilities are for large-scale scientific experiments and offer fundamental R&D and technology transfer services. Essentially, he added, science and technology programs mirror efforts seeking solutions to problems facing a country at different stages of social development.

In the 1980s, Minister Chen said, Taiwan had one of the highest hepatitis B infection rates in the world, with one in every five or six diagnosed as carriers. Taiwan became the first country in the world to implement universal vaccination measures for newborns in 1986, partially due to research from Taipei-based

National Taiwan University (NTU) Hospital. Such input from local academic and R&D institutes, Minister Chen added, plays a central role in formulating and realizing national science and technology strategies, including the one for developing HSP and other science parks.

For its part, HSP works closely with nearby National Tsing Hua University (NTHU) and National Chiao Tung University (NCTU), as well as state-backed Industrial Technology Research Institute (ITRI) headquartered in Hsinchu County. As an upgraded version of the export processing zones set up in the 1960s, HSP emerged at a time when computer, electronics and semiconductor industries began taking off on the world stage, Minister Chen said. "The government worked in sync with international trends to facilitate a homegrown industrial renovation and create added value in Taiwan."

This turned out to be a successful move, with the country emerging as a leading force in the global semiconductor industry. In



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2018, national output value reached NT\$2.6 trillion (US\$83.87 billion), up 6.4 percent year on year, as President Tsai Ing-wen (蔡英文) told executives from U.S.-based Semiconductor Equipment and Materials International and ITRI-headquartered Taiwan Semiconductor Industry Association during the Taipei-hosted SEMICON Taiwan in September.

Among the esteemed group was Taiwan Semiconductor Manufacturing Co. (TSMC) Chairman Mark Liu (劉德音). His HSP-based integrated circuit foundry has been making headlines recently for such developments as launching a trial run this year on its 5-nanometer

- 01. Formosat-7 awaits blastoff in June from Kennedy Space Center in Florida.
- 02. The Fundamental Science and Technology Act, promulgated in 1999
- 03. The first meeting of all members from the MOST's predecessor National Science Council takes place in 1967 in Taipei.
- 04. The NSC is restructured in 2014 into its current form.
- 05. An artist's impression of Formosat-2 in orbit
- 06. Professor Chien Chen-fu, second left, holds discussions with his team from MOST's Artificial Intelligence for Intelligent Manufacturing Systems Research Center based at National Tsing Hua University in northern Taiwan's Hsinchu City.

01 & 05. Courtesy of NSPO
06. Photo by Pang Chia-shan



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chip manufacturing process at STSP, as well as announcing plans to build a domestic 3-nanometer wafer fab.

Fresh Approach

Given the strength of the local information communication technology sector, Taiwan is moving from a hardware-oriented development model toward a more balanced one in tandem with the rise of software-focused industries. “Building a favorable computation environment for collection, analysis and application of big data is crucial for fostering the high-tech economy,” Minister Chen said. “Artificial intelligence [AI] is the future, and our younger generations must be guided in that direction with familiarization in coding language and logical thinking.”

Chien Chen-fu (簡禎富), a professor in NTHU’s Department of Industrial Engineering and Engineering Management, also envisions a brave new world restructured

by AI knowledge and capabilities. He is director of the NTHU-based Artificial Intelligence for Intelligent Manufacturing Systems Research Center (AIMS), one of the four AI research centers set up by the MOST under its AI Innovation Research Program. The other three targeting biomedicine, health care and pervasive AI are located at Tainan-based National Cheng Kung University, NTU and NCTU, respectively. Given the rapid adoption of AI, big data mining and analytics, cloud computing, Internet of Things and robotics, Chien said, the center is supporting corporate decision-making efforts and promoting digital transformation for large and small enterprises on the road to a 21st century industrial revolution.

Full Participation

A former TSMC administrator in the industrial engineering department, Chien recognizes the need to build academic-public-private collaborative ecosystems in Taiwan as the global manufacturing sectors embrace smart production patterns. The center, he said, utilizes funding from the MOST and enterprises while establishing itself as a quasi-independent entity operating in tertiary institutions with its own budget and personnel.

“If realized and promoted, this model will see ITRI-like units integrating efforts by researchers, scientists and specialists in diverse disciplines at different universities,” Chien said. This year, the AIMS Fellows project was launched for the intercollegiate level at NTHU to recruit 40 students for its executive master of business administration program.

According to Chien, Taiwan can share AIMS solutions and



exchange relevant experiences with other emerging countries such as Association of Southeast Asian Nations member states facing similar business remodeling issues. Minister Chen is on the same page in this regard. “We’re open to the world and to all countries big and small,” he said. “In some areas we can have greater interaction on a deeper level.”

Minister Chen views precision medicine, a medical model using molecular diagnostics and genetic analysis to provide customized health care services, as an effective way of realizing this goal. “Medicine

has long been a magnet for our best and brightest,” he said. “The talent pool is deep and represents a viable path going forward.”

The professor of electrical engineering at NTU and the school’s former vice president prescribes a narrowing of science and technology programs so as to achieve global leadership in select areas. “The objective is to make the most of available resources and develop a homegrown competitive edge,” he said. “Of course, the future is uncertain, but we must ensure all efforts and innovation benefit our people and society as a whole.”

01. Taiwan Semiconductor Manufacturing Co.’s integrated circuit foundry at Southern Taiwan Science Park
02. TSMC Chairman Mark Liu, third right, and other semiconductor industry executives give the thumbs-up at the Taipei-hosted 2019 SEMICON Taiwan.
03. President Tsai Ing-wen delivers opening remarks in December 2016 at the 10th edition of the quadrennial National Science and Technology Conference in Taipei.
04. Taiwan Tech Arena, a MOST initiative, is kicked off in June to strengthen the country’s innovative startup ecosystem.

01. Photo by Hao Chen-tai
02. Photo by Central News Agency

