
FACT SHEET

Industrial research institutes and industrial parks in Taiwan

1. Background

1.1 Taiwan has achieved notable economic development over the past half century. Starting out as an agriculture-based economy in the 1950s, Taiwan has transformed itself into a leading producer of high-technology products, with many of its semiconductor, optoelectronic and telecommunications goods commanding a large share of the global market. In 2009, Taiwan ranked first in the world in integrated circuit ("IC") packaging and testing, while placing second in IC design in terms of the global market share. In addition to the IC sector, Taiwan has successfully fostered the development of chemical, metal and machinery industries as its strategic industries.

1.2 Taiwan's economic transformation owes much of its success to, among other things, two major policy initiatives introduced during the 1970s and 1980s respectively. The establishment of the Industrial Technology Research Institute ("ITRI") in 1973, coupled with the opening of the first science-based industrial park in 1980, has helped foster the development of the high-technology industry in Taiwan. Currently, ITRI is the largest government-sponsored industrial research institute in Taiwan, entrusted with the mission of developing new technologies and transferring the results to local industries.

1.3 Against the above background, this fact sheet aims at providing the Panel on Commerce and Industry with the background information on the industrial research institutes in Taiwan, with special reference to the operation of ITRI. The fact sheet also describes the establishment and development of industrial parks in Taiwan.

2. Industrial research institutes

2.1 The Taiwan government has set up a number of government-sponsored research institutes to promote local industrial development. The nature of these research institutes is summarized in the table below.

Table 1 – Major industrial research institutes in Taiwan

	Research areas
Industrial Technology Research Institute	Founded in 1973 to engage in applied science researches and transfer the results to local industries for enhancing Taiwan's industrial competitiveness.
Institute for Information Industry	Established in 1979 to foster the development of the information and communications technology ("ICT") industry and promote the adoption of ICT in both the public and private sectors.
National Synchrotron Radiation Research Centre	Created in 1993 to operate a synchrotron radiation facility for pioneering pure and applied science researches and promoting industrial development in Taiwan.
National Applied Research Laboratories	Set up in 2003 to support academic researches and technological development by promoting the integration of laboratory resources into cutting-edge researches on pure and applied sciences.

2.2 Among these research institutes, ITRI is the largest in terms of the number of staff employed and the funding received. In 2009, ITRI received a funding of about NT\$17.7 billion (HK\$4.3 billion¹), and employed more than 6 000 research and administrative staff (60% of whom with either a master or doctoral degree).

Industrial Technology Research Institute

Mission

2.3 ITRI was founded in 1973 by the Ministry of Economic Affairs to meet the technological needs of Taiwan's industrial development². Since its inception, ITRI has served as the technical arm of the government's industrial policy bureaux. In particular, ITRI's mission is to:

- (a) engage in applied researches and provide technical services to accelerate the industrial development in Taiwan;
- (b) develop key, compatible, forward-looking technologies to meet the local industrial needs and strengthen the competitiveness of Taiwan's industries; and
- (c) disseminate research results to local industries in a timely and appropriate manner, in accordance with the principles of fairness and openness.

¹ Based on the average exchange rate of HK\$0.243 per New Taiwan Dollar in 2009.

² In the early 1970s, the Taiwan government recognized the need to embark on an export-oriented strategy, complemented by the development of local industrial technology, to sustain the economic growth. At that time, Taiwan's manufacturing industry was characterized by the dominance of small- and medium-sized firms which lacked the expertise and research and development ("R&D") capacity to develop new technologies. As a result, the Taiwan government founded ITRI in 1973 as a non-profit R&D organization to (a) conduct researches on new technologies and (b) help upgrade existing industries through technology transfer. See Jan (2006) and Chu (2006).

Organizational structure

2.4 Headquartered at Hsinchu County (the Chung Hsing Campus), ITRI has smaller research campuses in Hsinchu City (the Kuangfu Campus) and Tainan. In addition, ITRI maintains overseas offices in Silicon Valley, Tokyo, Berlin and Moscow.

2.5 As a multi-disciplinary research centre, ITRI has established six core laboratories, three focus centres, four linkage centres, several leading laboratories and various business development units. ITRI focuses its researches on six fields of advanced technologies, namely (a) information and communications technologies, (b) electronics and optoelectronics technologies, (c) material and chemical technologies, and nanotechnology, (d) medical device and biomedical technologies, (e) mechanical and systems technologies, and (f) green energy and environment technologies.

Funding

2.6 ITRI derives half of its funding from the government under the National Science and Technology Programme, and the other half from private research and service contracts. The National Science and Technology Programme was implemented by the Ministry of Economic Affairs in 1979 to promote the development of Taiwan's industrial technology. Under the Programme, government-sponsored research institutes submit research proposals to the Ministry and compete with the private sector and academics for funding to carry out researches on advanced technologies. ITRI's funding totalled NT\$17.7 billion (HK\$4.3 billion) in 2009, of which NT\$9.5 billion (HK\$2.3 billion) or 54% came from the National Science and Technology Programme.

Operation

2.7 The core of ITRI's operation consists of conducting basic and applied researches on various advanced technologies. Research projects are conducted in close cooperation with, and sometimes with financial support from, small- and medium-sized companies. The results of these researches are transferred to local industries for further development and eventual commercialization of the new technologies³. For technology diffusion, ITRI grants/licenses about 1 000 patents and transfers hundreds of items of technology to the industrial sector each year⁴.

2.8 Most new technologies developed by ITRI are transferred to the private sector. In some cases, ITRI would spin off the technical team concerned (usually with the managerial, accounting and marketing personnel) and create a private firm. The first spin-off took place in 1979 when ITRI relocated a research and development ("R&D") team to form the United Microelectronics Corporation, the first semiconductor manufacturing company in Taiwan⁵. The success of the United Microelectronics Corporation precipitated the spin-offs of the Taiwan Semiconductor Manufacturing Corporation in 1987, the Taiwan Mask Corporation in 1988, and the Vanguard International Semiconductor Corporation in 1994. Starting out as R&D teams within ITRI, these spin-off companies have developed into Taiwan's flagship semiconductor companies with a strong presence in the global market.

³ A prominent example was its transfer of semiconductor processing technology from a leading US electronics firm to Taiwan in 1975, which set the stage for the development of Taiwan's leadership in IC production today.

⁴ ITRI transferred 423 items of technology to 491 firms in 2010.

⁵ Before the establishment of the United Microelectronics Corporation, there was no semiconductor manufacturing company in Taiwan. The capital required and the risks involved rendered a general lack of confidence in setting up semiconductor manufacturing companies in the private sector. This prompted ITRI to spin off the United Microelectronics Corporation, as its success would not only pave the way for the creation of strategic industries in Taiwan, but also serve as a show-case model to inspire private investment in the semiconductor industry.

2.9 In addition to its research units, ITRI set up the Open Lab in 1996 to provide space, facilities and access to ITRI's technological resources for local industries to engage in joint R&D activities with ITRI researchers. The Open Lab also operates an "incubation centre" which provides start-up enterprises with a supporting environment and the expertise to run their businesses at the early stage. Of particular relevance is the provision of access to ITRI's facilities and advice/assistance on technical, finance, legal, marketing and management matters.

3. Industrial parks

3.1 The Taiwan government opened the first industrial park – the Liutu Industrial Zone – in 1960. The construction of industrial parks continued in the ensuing years under the government policy to provide the infrastructure necessary for developing labour-intensive and export-oriented industries in Taiwan. These industrial parks provided land and common facilities for the construction of standard factory buildings leased out to small- and medium-sized firms. Specialized industrial parks for the shipbuilding, petrochemical and steel industries were also built during the 1970s to cope with the government strategy of developing heavy and chemical industries in Taiwan⁶.

⁶ See Xue (1997).

3.2 In the late 1970s, the appreciation of the New Taiwan dollar, rising labour and land costs, and increasing environmental consciousness conspired to undermine the competitiveness of Taiwan's export industries. In these circumstances, the Taiwan government shifted its economic development policy to focus on the establishment of local capital and technology-intensive industries. Inspired by the global trend towards establishing science parks for technology diffusion⁷, the Taiwan government enacted the *Statute for the Establishment and Administration of Science-based Industrial Parks* in July 1979, setting out the legislative framework for the establishment and operation of science-based industrial parks in Taiwan.

3.3 In December 1980, the first science-based industrial park – the Hsinchu Science Park ("HSP") – was opened in northwest Taiwan to create an environment conducive to high-technology R&D. HSP is adjacent to ITRI and two science and technology universities (National Chiao Tung University and National Tsing Hua University), which helps generate the economic benefits of industry clustering. At present, the tenant mix of HSP includes a number of companies spun off from ITRI and the two universities. In addition, the close proximity to the academic and research institutes ensures the HSP tenant companies a steady supply of highly skilled and innovative manpower and technical support for their R&D projects⁸.

3.4 Since the establishment of HSP, the Taiwan government has been actively promoting the development of specialized industrial parks throughout the island. The notable projects included:

- (a) science-based industrial parks in southern and central Taiwan;
- (b) technology industrial zones in Yunlin and Tainan;

⁷ The first science and technology park was created on the campus of Stanford University in the 1950s. It has helped transform the Silicon Valley area from one of the poorest regions in the United States ("US") into a global centre of technology, finance, education and research. This successful business model was duplicated throughout the US in the 1960s, in Europe in the 1970s, and then globally during the subsequent decades.

⁸ During the past decades, National Chiao Tung University and National Tsing Hua University have benefited HSP through seminars and training courses, and technology transfer via research contracts and faculty consultancy.

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- (c) computer-software industrial park in Nankang;
 - (d) bio-technology industrial park in Hsinchu;
 - (e) research parks in Chingshan and Taichung;
 - (f) high-technology industrial parks in Kaohsiung and Hsinchu; and
 - (g) environmental technology industrial parks in Hualien, Taoyuan, Tainan and Kaohsiung.

Science-based industrial parks

3.5 Currently, there are three science-based industrial parks in northern, central and southern Taiwan. HSP, established in northwest Taiwan in 1980, was the first and best developed among the three science-based industrial parks in Taiwan. The second science-based industrial park, the Southern Taiwan Science Park ("STSP"), was opened in 1997 with the objectives of (a) alleviating the imbalanced industrial developments between northern and southern Taiwan, and (b) accelerating the development of high-technology industries in southern Taiwan. After the establishment of HSP and STSP, the Taiwan government opened the third science-based industrial park – the Central Taiwan Science Park ("CTSP") – in 2003 to connect it with HSP and STSP to form a high-technology corridor in western Taiwan. The profile of the three science-based industrial parks is summarized in the table below.

Table 2 – Profile of science-based industrial parks in Taiwan

	Location	Opening year	Main campus	Satellite science park	Major industry clusters	Number of universities nearby
Hsinchu Science Park	Northwest Taiwan (encompassing Hsinchu County and Hsinchu City)	1980	Hsinchu Science Park (653 hectares)	Comprising five satellite science parks: (a) Jhunan Park (123 hectares); (b) Longtan Park (76 hectares); (c) Hsinchu Biomedical Science Park (38 hectares); (d) Tonglou Park (350 hectares); and (e) Yilan Park (71 hectares).	Semiconductor and optoelectronics industries	5
Southern Taiwan Science Park	Southern Taiwan (Tainan County)	1997	Tainan Science Park (1 043 hectares) and Kaohsiung Science Park (570 hectares)	Nil.	Optoelectronics, IC, precision machinery, bio-technology and telecommunications industries	6
Central Taiwan Science Park	Central Taiwan (Taichung and Yunlin)	2003	Taichung Science Park (413 hectares)	Comprising three satellite parks: (a) Houli Science Park (256 hectares); (b) Huwei Science Park (97 hectares); and (c) Erlin Science Park ⁽¹⁾	Optoelectronics and precision machinery industries	12

Note: (1) The Erlin Science Park, covering an estimated area of 635.91 hectares, is still under construction, and its most important construction projects are scheduled to be completed by 2017.

Sources: 行政院國家科學委員會 (2010) and 國立暨南大學管理學院 (2006).

Park administration

3.6 The science-based industrial parks are administered by the National Science Council of the Ministry of Economic Affairs⁹ to:

- (a) establish a base for the development of high-technology industries;
- (b) utilize the resources from the industry, government, and academic sectors to create an innovative environment that smoothly integrates R&D with the product design and production of local manufacturing industries; and
- (c) strengthen Taiwan's industrial base by improving the link between the technology development/generation and transfer.

Incentives for park tenant companies

3.7 The Taiwan government has provided a number of tax and investment incentives for companies moving to the science-based industrial parks. These incentives include:

- (a) exemption from import duties and enterprise tax;
- (b) tax-deductible R&D expenses;
- (c) foreign investors enjoying the same benefits and rights as domestic investors;

⁹ The National Science Council is the primary government agency responsible for planning and promoting the scientific and technological development in Taiwan.

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- (d) low-interest loans for purchasing equipment or constructing factory buildings;
 - (e) government grants to develop innovative technology with the amount being capped at NT\$5 million (HK\$1.2 million) or 50% of the total project costs¹⁰; and
 - (f) government's investment in a private enterprise up to 49% of the total equity of the invested enterprise.

Business operation

3.8 HSP is home to many local renowned information technology and semiconductor firms, including the United Microelectronics Corporation and the Taiwan Semiconductor Manufacturing Corporation. There are also a number of major foreign or foreign-invested firms in HSP, including Royal Philips Electronics (Netherlands), Mitsubishi, Shin-Etsu and OptoElectronics (Japan), Dupont and Motorola (US), Logitech (Switzerland), and Siemens (Germany). At end-2009, a total of 477 companies had received approval to set up operation in HSP. The corresponding figure for STSP and CTSP was 167 and 108 respectively. The park tenant companies are mainly engaged in high-technology industries such as IC, computer and peripherals, optoelectronics, precision machinery and bio-technology industries (see **Table 3**).

¹⁰ In addition to the tax and investment incentives, the Taiwan government also charges low rentals and reduced utility fees for firms established within the science-based industrial parks.

Table 3 – Number of firms receiving approval to set up operation in science-based industrial parks, 2009

	Integrated circuit	Optoelectronics	Computer and peripherals	Telecommunications	Precision machinery	Bio-technology	Others	Total
Hsinchu Science Park	197	101	55	49	33	36	6	477
Central Taiwan Science Park	8	31	6	1	36	16	10	108
Southern Taiwan Central Park	13	45	3	12	43	44	7	167

Source: 行政院國家科學委員會 (2010).

3.9 Combined sales revenue of the companies at the three science-based industrial parks totalled NT\$1.94 trillion (HK\$471 billion) at end-2009. HSP accounted for 50% of the sales revenue, followed by STSP's 31% and CTSP's 19%. Within HSP, IC companies accounted for 68% or NT\$658 billion (HK\$160 billion) of the total sales revenue at end-2009 (see **Table 4**). Meanwhile, CTSP derived most of its sales revenue (70%) from optoelectronics companies. For STSP, optoelectronics and IC companies together had the largest turnover at end-2009, accounting for 57% and 35% of the total sales revenue respectively.

Table 4 – Sales revenue of science-based industrial parks by industry, 2009 (NT\$ billion)

	Integrated circuit	Optoelectronics	Computer and peripherals	Telecommunications	Precision machinery	Bio-technology	Others	Total
Hsinchu Science Park	657.98 (67.5%)	202.51 (20.8%)	62.71 (6.4%)	26.95 (2.8%)	17.59 (1.8%)	4.27 (0.4%)	2.77 (0.3%)	974.78
Central Taiwan Science Park	96.3 (26.6%)	252.71 (69.7%)	1.03 (0.3%)	0 (0%)	11.44 (3.2%)	0.25 (*)	0.83 (0.2%)	362.54
Southern Taiwan Central Park	213.0 (35.2%)	347.24 (57.3%)	1.39 (0.2%)	3.23 (0.5%)	33.12 (5.5%)	5.36 (0.9%)	2.54 (0.4%)	605.88

Notes: Figures may not add up to the respective totals due to rounding.

Figures in the parentheses represent the percentage shares of the total sales revenue.

(*) Less than 0.1%

Source: 行政院國家科學委員會 (2010).

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