Taiwan

- by A V Vedpurishwar

Taiwan is today considered one of the most enterprising nations in the world. Once referred to by the Economist Magazine as The Silicon Valley of the east, Taiwan's progress in the last few decades, despite being a small country with a little over 20 million people, has indeed been remarkable. Taiwan is handicapped by a lack of resources. It imports nearly all of its energy, most raw materials and various manufactured goods and agricultural items. But over the past fifty years, hard work and sound economic management have built the country into an economic powerhouse, with the world's third largest foreign exchange reserves. Its 23 million people enjoy a per capita Gross Domestic Product of almost $15,000. Now-a-days, the Taiwanese model of development has become a case study for many developing countries.

Taiwan's educated work force, advanced infrastructure, strategic location and a highly pro-business environment make it an excellent place to invest. A significant portion of Taiwan's economy is still controlled by the government, but the trend is clearly towards privatization and liberalization. The Taiwanese authorities have been reducing tariff and non-tariff barriers as part of the country's anticipated accession to the World Trade Organization. Restrictions on financial institutions are gradually being lifted; several public firms have been privatized; and private sector competition is being introduced in telecommunications, power generation a oil refining and distribution.

The Taiwanese industry is driven by small and medium enterprises, which have made a name for themselves in the global marketplace, even in high-tech industries such as micro processors. Today, Taiwan is the third largest producer of IT products in the world, after the US and Japan. In 1998, Taiwan's worldwide market share in various product categories was: hand-held scanners - 96 percent, desktop scanners - 69 percent, mouses - 63 percent, motherboards - 60 percent, monitors - 54 percent, modems - 48 percent, notebooks - 32 percent. If there is one word which gives the right picture about Taiwan, it is flexibility. Companies are easy to start and easy to close. Venture capital is easily available and bankruptcy laws make exits relatively painless.

Manufacturing efficiencies have been the single most important factor behind the success of Taiwan's enterprises. Many Taiwanese companies concentrate on contract manufacturing and leave the marketing to western MNCs. At the same time, Taiwan does have a few brands to talk about. Giant is a global leader in the bicycles business while Acer is one of the largest PC manufacturers in the world.

Table 1

Main economic indicators, 1999	
Real GDP growth (%)	5.7
Consumer price inflation (av; %)	0.2
Current-account balance (US$ bn)	5,784
Exchange rate (av; NT$: US$)	32.3
Population (m; mid-year)	21.95
Foreign debt (year-end; US$ m)	31,535

Source : EIU, CountryData

The Taiwanese model attracted attention during the Asian currency crisis, when countries like South Korea, with large diversified conglomerates faced the music. Taiwan not only handled the onslaught successfully but its economy has shown robust growth over the past two years despite the lingering effects of the Asian financial crisis, heightened cross-strait political tensions and a major earthquake which struck central Taiwan in September 1999, inflicting heavy damage and loss of life.

Today, Taiwan is not without its problems. Its banking system needs to be upgraded. And software capabilities need to be significantly enhanced in a world where hardware is becoming less and less important. There is however, every livelihood that Taiwan will face these challenges successfully.

Economic Policies

After its independence in 1945, the state played a dominant role in Taiwan's economic development although the private sector was also encouraged. From the mid 1970s, private business become more independent. The government continued, however, to run key industries (electricity, steel, petroleum), construct basic infrastructure (railways, highways, waterways), oversee the financial system (both government and private banks), and initiate the development of new sectors by facilitating the transfer of technology and by disseminating market information.

Prior to the mid- 1980s, the Taiwanese government's goal was to encourage a shift from subsistence agriculture to industry. Import substitution policies were designed to accelerate industrial development by encouraging heavy industries. Foreign direct investment was subjected to close scrutiny. The government kept interest rates low, implemented strict foreign exchange controls, maintained a fixed exchange rate, and directed credit with the goal of promoting the rapid growth of the domestic economy. By the mid - 1980s, Taiwan had become a successful exporter and had built up a substantial current account surplus and foreign exchange reserves, But the high degree of government intervention distorted the economy and, in particular, the financial sector.

In the late 1980s, capital controls were lifted, the undervalued exchange rate was freed up, and direct foreign investment reviews were eased.

Table II

Comparative economic indicators, 1999

	Taiwan	China	Hongkong	US	Japan
GDP (US$ bn)	288.6	976.3	158.8	9256.2	4350.5
GDP per head (US$)	13,147	778	23,213	33,889	34,341
GDP per head (US$ at PPP)	21,291	4,280	24,010	33,889	24,342
Consumer price inflation (av; %)	0.2	-1.3	-3.3	2.2	-0.3
Current-account balance (US$ bn)	5.8	19.0	6.3	-338.9	106.9
% of GDP	2.0	1.9	4.0	-3.7	2.5
Exports of goods fob (US$ bn)	121.12	194.9	175.7	685.3	403.7
Imports of goods fob (US$ bn)	-106.08	-159.0	-178.7	-1,030.2	-280.4

Source : EIU, CountryData

Global branding by Taiwanese Companies: Acer's Experience

Many Taiwanese companies have preferred to be OEM contractors to global players with established brands. This has enabled them to conserve resources, which would have been otherwise needed to run expensive global marketing campaigns. The Acer group is an exception in this context.

Acer was established in 1976. Founder Chairman Stan Shih has led Acer's globalization efforts since then to make the company the third largest PC manufacturer in the world. In 1998, Acer generated 24.1 percent of its sales in the Asia Pacific, 24.3 percent in Europe, 4.2 percent in Latin America, and 41.6 percent in North America with only 9.5 percent of its sales coming from the home country. Total worldwide sales amounted to $6.717 billion in 1998. Acer currently operates 176 subsidiaries, employing about 32,000 employees in 42 countries offering a wide product range, including PCs, servers, notebook computers, networking solutions, ISP services and various types of peripherals. Acer has appointed more than 10,000 resellers in 100 countries.

After developing a strong presence in South East Asia and Latin America, Acer decided to target the US market with its popular Aspire Home PC, only to find itself being outmaneuvered by stronger rivals such as Dell with superior marketing capabilities. As the Aspire line began to pile up losses, Acer announced that it would concentrate on its Power PCs, backed by a $10 million marketing campaign to target small and medium businesses. Acer also indicated that it would seriously consider launching low cost computer appliances called XCs priced $200 or lower once they were established in Asia. Notwithstanding these moves, Acer's market share slipped from 5.4 percent (late 1995) to 3.2 percent (late 1998) and it began to make losses in the US market.

Shih had once told his executives that a strong presence in America was vital to the development of a global brand: "It's almost a mission impossible but all of our people are ready to fight for that mission." These hopes however were belied and after losing $45 million in the US, in 1999, Acer began to retreat from the US consumer market. Acer's experience is a warning to companies with global pretensions, in emerging markets that substantial financial resources and strong marketing capabilities are required to enter developed markets such as the US, where competition can be cut throat.

Today Acer makes products for other global companies but it also sells under its own brand name. Acer's own brand operations are however, struggling while its contract operations are profitable. To conserve resources, Acer is shifting the focus of its own brand marketing activities away from the US to Asia and Europe.

Acer has faced several problems in its attempt to create its own brands. Some customers feel that doing both contract work and on brand activities will lead to conflict of interest. Consequently, many companies are shying away from giving manufacturing work to Acer. Responding to this trend, Acer has announced that it will split the company into two. The brand operation will contract work to the lowest bidder. And for the contract operations, Acer will be just another customer.

Trade policy was liberalized and tariff and non-tariff barriers were reduced. The 1989 New Banking Law reforms were aimed at strengthening regulatory controls over the financial sector and helping banks become more competitive *vis-á-vis* the informal financial sector. Major reforms included steps toward privatizing commercial banks, removing controls on interest rates, and developing laws to convict those engaged in illegal financial activities.

In recent times, the government has been reducing its direct intervention in the economy. A number of construction projects (including a north-south high-speed railway, a massive rapid transit system in Kaohsiung City, and another MRT system between Taipei and CKS Airport) have been given to private firms to execute on a build-operate-transfer basis. Private firms have also been permitted to build independent power plants. Oil refinery and gasoline distribution has been liberalized. Over the past two

years, the Taiwanese authorities have sold equity shares and reduced public ownership to below 50 percent in 15 state-owned enterprises, including five large banks, a big steel mill, and a fertilizer company. Privatization will cover power, oil, tobacco, wine railway transport, insurance and telecommunication firms.

Today, three aspects of Taiwan's governance stand out-contracting out services, electronic government and BOT (Build, Operate, Transfer) programs. The government outsources many services. For example, the Taipei City government has contracted out garbage collection, public parking lots management, car inspection, violation towing, day care, elderly care, parks management, statistical data collection and coding and so on. The Kaohsiung City government has contracted out the construction of mass rapid transit, car inspection, government buildings cleaning, public safety systems, etc.

Electronic government has also been an important item on the agenda for the government. A government services network (GSN), using intranet and internet provides information and services. Electronic tax administration, electronic public health, electronic public safety, and electronic commerce have helped the government meet the public's needs more efficiently. The major BOT programs include the mass rapid transit (MRT) of Chang Kai-Shek International Airport, the High Speed Rail (which will shorten the travel time from Taipel to Kaohsiung to only 90 minutes). Taipei International Finance Building and Taichung Mall.

Some important aspects of Taiwan's approach to industrial development need to be highlighted. Intense domestic competition has been encouraged. The government has actively promoted the development and modernization of Taiwan's Small & Medium Enterprises (SME) sector. Equal

Semiconductor fabrication: Taiwan's global players

Many companies today outsource production of their integrated circuits. The foundry business, as chip manufacturing is called, is expected to account for about 25 percent of the global chip production by 2004. It is in this context that the bold strides by Taiwan Semiconductor Manufacturing Company (TSMC) and United Microelectronics Corporation (UMC) need to be viewed. In 2000, TSMC generated revenues of $5 billion and UMC, $3 billion. Quite clearly, the two companies are global players in the chip fabrication business. But the two companies, inspite of having overseas plants, have kept most of their capacity in Taiwan. The Hsinchu cluster with its related and supporting industries has been a major factor influencing this strategy.

TSMC's founder Morris Chang had earlier worked for Texas Instruments in the US. TSMC started in 1987 as a spin off from a government research project. The venture received capital from the government and capital and technical support from Philips, the Dutch Multinational. While integrated device manufacturers had inhouse fabrication facilities, (fabs), many fabless designers began to outsource production from TSMC. In 2000, foundries had a 16 percent share of the global chip market and TSMC had a 41 percent share of the foundry market.

UMC was founded in 1980 as an integrated device maker, which later began to provide foundry services. In the mid-1990s, UMC put up new fabs, many of them as joint ventures with companies like Hitachi. Today, UMC has 9400 employees and eight fabs, including one in Japan.

The two companies are now attempting to strengthen their competitive advantage by moving on to 300 mm wafers. Both have not hesitated to make heavy investments, inspite of the slowdown in the semiconductor market during 1996-98. That slowdown had made many US, European and Japanese chip makers hesitate to make huge commitments. By the time, integrated device manufacturers set up their 300m Fabs, if at all, TSMC and UMC are likely to be up and running. The integrated players may also hesitate to make $3 billion plus investments, especially at a time when things are not looking up.

treatment has been granted to domestic and foreign investment, with the exception of some majority share-holding regulations applicable to foreign firms and strict foreign exchange control regulations governing domestic firms. Directed credit has played a much less important role in Taiwan's development. Unlike, Korea which used its control of the finance sector to direct credit to a handful of Chaebols, the Taiwanese government has not attempted to promote large national champions.

Unlike Japan and Korea, where government - directed bailouts of ailing companies are common, in Taiwan, sick companies are allowed to go bankrupt. It is also easy for new start-ups to attract investors, thanks to a thriving venture capital industry. In 1991, 40 percent of chemicals, 38 percent of textiles and 54.2 percent of fabricated metals in Taiwan were produced by companies that had been in existence for less than five years. Firms that had accounted for 58 percent of Taiwan's chemical production in 1981 had left the business by 1991. 80 percent of the firms that manufactured clothing, metal products, textiles and plastics in 1981, either closed or moved into new businesses over the next 10 years. In 1996, some 25,272 companies went out of business, 4.7 percent of the total.

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The government's ambitious Asia-Pacific Regional Operations Center (APROC) plan, launched in January 1995, is an example of its determination to take the country up the value chain. The plan aims to make Taiwan a regional center for manufacturing, services, and transportation, by liberalizing the economy, lowering trade barriers, and eliminating unnecessary regulations. Hundreds of items have been targeted for liberalization, ranging from banks to foreign exchange to telecommunications.

In Phase one, 39 out of 71 selected laws were amended or enacted, 90 out of 92 administrative orders were revised, and 35 out of 38 administrative measures were taken. Reforms included lowering telecom charges, deregulating foreign investment in certain businesses, simplifying entry and exit procedures for foreigners, reducing customs clearance for maritime cargo, and easing restrictions on foreign exchange. At the end of the first phase, Taiwan had already attracted investments worth US $10 billion.

Phase two, which began in July 1997, has identified 54 laws, 105 administrative orders, 98 administrative measures, and 10 procedures that need reform. Key areas include deregulating financial markets to allow free capital flows, and fostering further competition in the telecom industry. Already, phase two has passed 38 out of a targeted 77 laws. Cellular phone rates have been cut in half, and international direct dial (IDD) charges have been cut by two thirds, giving Taiwan one of the lowest IDD rates in Asia. In sea transportation, Taiwan has sharply reduced loading and unloading costs and has instituted a trans-shipment scheme, which allows cargo from China to come to Taiwan, where it is sorted and shipped to ports all over the world.

Industrial Base

In the 1950s and '60s Taiwan's main strength was its abundant supply of cheap labour. Consequently, labour-intensive light industry predominated,

producing nondurable consumer goods such as foodstuffs and textiles, at first largely for domestic consumption but after 1960 increasingly for export. By the 1960s and '70s, investment had shifted to more capital-intensive heavy industries, consumer durables (appliances, vehicles), industrial nondurables (steel, petrochemicals), and industrial durables (machinery, ships). In the 1970s, labour became scarce and wages increased, making Taiwan's labour-intensive exports less competitive. Consequently, the country stepped up efforts to develop skill-intensive high-technology industries including specialty chemicals, pharmaceuticals, precision instruments, sophisticated electronics, and information-processing systems.

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Taiwan's large build-up of foreign reserves and the establishment of the required infrastructure facilitated the growth of the steel, shipbuilding and petrochemical industries. At the same time, electricity, telecommunication and transportation industries were also developed. This enabled Taiwan to maintain an average industrial growth rate of 14.1 percent, even with two energy crises and subsequent global recessions.

Because of Taiwan's limited resources and lack of advanced technology, its manufactures depended heavily on imported materials, equipment, and technology (particularly from Japan and the United States). Moreover, because of the limited domestic market, Taiwan also depended heavily on exports (particularly to the United States). Until the mid-1980s, Taiwan balanced a chronic trade deficit with Japan against a chronic trade surplus with the United States. In the 1980s, Taiwan attempted to diversify its customer base by boosting exports to Europe and the Third World.

By the late 20th century manufactured goods accounted for more than 95 percent of all exports, led by electronic products and appliances, clothing, footwear, textile yarns and fabrics, toys and sporting goods, and metal products. Imports were highly diversified, consisting of a variety of consumer goods and raw materials, including petroleum and petroleum products, electronic products, non-electrical machinery, and chemicals.

The percentage of technology-intensive industries within the manufacturing sector rose from 24 in 1986 to 38.8 in 1997. The average growth rate of technology-intensive industries was 10.7 percent during this period, compared to 6.2 percent for the manufacturing sector as a whole.

The small size of Taiwanese companies has not proved to be a handicap while competing in the global market place. Many of them firms have established a reputation for establishing networks that address questions such as – ***what place to produce raw materials or semi-processed goods what channels should be taken for transport, where things can be assembled and how customs clearance can be obtained.*** Not only do manufacturing industries, up and down stream, have smooth and high levels of mutual understanding, firms realize that it is in everyone's interest to integrate and cooperate. The formation of a network has enabled Taiwanese firms to acquire a level of manufacturing sophistication that compares favourably with large multinationals.

An area where Taiwanese companies have excelled is global value chain configuration. By the mid-1980s, quite a few Taiwanese enterprises in labor-intensive manufacturing fields had already lost their competitive edge and moved their operations overseas. Their parent companies in Taiwan looked after overall planning, design, R&D and marketing, concentrating more on technology-intensive activities. On the other hand, routine operations were transferred to South East Asian countries where wages were lower. China also became an attractive country to invest after the mainland opened its economy.

Taiwanese enterprises have also invested $5.3 billion in six different Southeast Asian nations (Thailand, Malaysia, Indonesia, the Philippines, Singapore and Vietnam), putting this area in second place at 15 percent. Taiwan investment in the United States stands at US $4.4 bn, putting it in third place at 12.5 percent.

In general however, Taiwanese firms are still weak in technology and marketing. True, technology-intensive manufacturing output value has grown from 28.3 percent in 1988 to 47.3 percent in the first three quarters of 1999. Technology-intensive products also accounted 59.2 percent of total exports during 1999. Taiwan also has the ability to carry out original design manufacturing (ODM) for leading computer brands. Yet, R&D in Taiwanese firms still largely consists of improving existing products. Very few enterprises are capable of completely innovative development. Basic research and standards for new products are still created in places like Silicon Valley.

Most Taiwanese companies have a long way to go in building global brands. Executives at Acer's Taipei headquarters and the regional headquarters in the Netherlands in a recent survey admitted that a large gap existed with regard to the marketing achievements of its business in Taiwan and Europe. On all the marketing aspects mentioned (brand name, distribution channels, advertising and promotion skills, sales force, service rendered, knowledge of customer's needs and the loyalty of customers) Acer perceived its position in Europe as substantially weaker than in Taiwan. In most countries, brand awareness, was still too low.

Taiwan's Computer Industry

Over the last decade, Taiwan has established itself as a world-class supplier for a variety of electronic hardware products. It is the world's largest supplier of computer monitors, motherboards, switching power supplies, mouse devices, keyboards, scanners and a variety of add-on cards. Almost 60 percent of the world's desktop PCs are either made in Taiwan or contain a motherboard made by a Taiwanese company. Since 1994, Taiwan also has become the world's largest manufacturer of notebook PCs. Taiwanese firms have upgraded their capabilities: a rapid diversification beyond hard core PC-related products into a variety of complementary, high-growth market segments and a shift from stand-alone manufacturing services to integrated service packages.

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Most of the computers made in Taiwan are sold to American and Japanese computer companies which re-sell them under their own logo. But much of the

design has been done by Taiwanese companies. Compaq for instance has made Mitac responsible for the design and development, as well as for manufacturing, transport and after-sales service.

Operational efficiency is the main strength of the Taiwanese computer industry. Companies have taken several initiatives to streamline their supply chain management practices. Mitac's 250 odd suppliers are electronically linked and capable of responding to its requirement within 24 hours. Basic components such as keyboards are manufactured at Mitac's factory in Shunde, China. Complex components are made in Taiwan and the US. The final assembly takes place at Freemont, California. Mitac takes orders from customers over the Internet and supplies the machines under different brand names such as Compaq and HP direct to US dealers.

Taiwanese companies have also emerged as global leaders in niche segments. Take scanners for example. Scanner production demands optical, mechanical and electronic technologies and capabilities. Taiwan has developed expertise in all three, and has become the world's largest supplier of scanners. With capabilities in R&D, production, marketing and after-sales service, Taiwan is positioned to defend its leadership position as a one-stop shopping center for scanners.

Leading firms in Taiwan's computer industry have moved beyond production, to encompass an increasing variety of knowledge-intensive, high-end support services. Consider Compaq's arrangement with Inventa, a family-owned Taiwanese company that has earned a reputation for innovative notebook design and that has already supplied notebooks on an original-design-manufacturing (ODM) basis to Dell and Zenith, an affiliate of the French computer firm, Bull. Inventa has access to low-cost volume production facilities in China and Southeast Asia, primarily Malaysia. Inventa uses sophisticated quality control, a skill which it has mastered by making Texas Instrument's calculators for 15 years. But what has really impressed Compaq is Inventa's specialized design capabilities for notebook computers. Compaq has integrated Inventa into its product development efforts and shared some of its tacit knowledge on design-for-manufacturing, and on global supply chain management. All this has provided important learning opportunities for Inventa.

Taiwanese computer companies have also realized the importance of keeping pace with changing technology. Lite On Technology Corporation, which makes monitors and CD-ROM drives, holds stakes in Silicon Valley firms that provide the latest technologies. It also has a holding in Omni Vision, a company which makes sensors used in digital still cameras and PC cameras for video conferencing. However, much more needs to be done by Taiwanese companies to strengthen their domestic R&D capabilities. Taiwanese firms will also need to locate R&D labs as listening posts abroad in the relevant centres of excellence in the U S., Japan and Europe. To do this requires a variety of joint ventures and strategic alliances with major international electronics firms. Software capabilities also need to be strengthened.

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How did Taiwanese firms succeed in the computer industry? In the volatile computer industry, Taiwanese firms have succeeded due to their

flexibility and the capacity to adjust to abrupt and frequently unexpected changes in demand and technology. Small size has aided flexibility.

By combining incremental product innovation with fast speed-to-market, Taiwanese firms have been able to establish a strong international market position relatively early in the product cycle. And by engaging in single tasks and by producing, purchasing and selling in small lots, Taiwanese firms not only avoid heavy fixed capital costs, but can also easily shift production effortlessly at relatively short notice. Deep and vibrant clusters have helped these firms to avoid possible disadvantages of specialization. Tight linkages between firms along the supply chain have facilitated inter-organizational knowledge creation, for instance between end product manufacturers and component suppliers. To fulfill an OEM contract, large Taiwanese companies like Tatung, FIC, Mitac and Acer rely on hundreds of loosely affiliated domestic suppliers to which they can pass on various low-margin, yet quite demanding manufacturing and design tasks.

Moving up the value chain

In the early 1960s, the Taiwanese Government introduced a series of path-breaking institutional policy innovations for encouraging knowledge creation. A statute for technical cooperation, issued in 1962, (under which re-investment and the remittance of technology fees accompanying joint ventures were permitted), aimed to attract technology from foreign companies. The 1965 Law on the Establishment and Management of Export Processing Zones was first implemented in December 1966 in Kaohsiung, a port city in the south of the island.

In 1973, the Industrial Technology Research Institute (ITRI) was established. The ITRI soon moved beyond its original task, which was to develop applied industrial technologies for key components and capital equipment. Its work now includes international technology scanning and acquisition; technology transfer from foreign sources to domestic industries, the development of a nation-wide infrastructure and the formation of specialized clusters of support industries. ITRI and its specialized divisions have facilitated innovation by encouraging top researchers and engineers to move out into the private sector and to establish innovative start-up companies. One of ITRI's important initiatives is the Hsinchu Science Park in 1980, a science-based industrial park, set up in 1990 to facilitate the growth of high-tech industries. This park receives much of its funding from the National Science Council, a government funded agency.

Technology development strategy for Taiwan's government has shifted from non-profit research institutes to the private sector

In the past, the Taiwanese government supported R&D activities only by entrusting non-profit research institutes to perform such projects and then passing the results of the projects on to industry for commercialization. Taiwan's integrated circuit (IC) industry is a successful example. As Taiwan's IC industry developed, TSMC (Taiwan Semiconductor Manufacturing Company), UMC (United Microelectronics Corporation), TMC (Taiwan Mask Corporation), VISC (Vanguard International Semiconductor Corp.) etc, were established. Now the technology development strategy for Taiwan's government has shifted from non-profit research

institutes to the private sector. The government continues to play the role of facilitator.

To upgrade industrial technology in accordance with the needs of industry, a Department of Industry Technology (DOIT) has been set up. The major task of DOIT is to formulate industrial technology development policies and to distribute funding for the Technology Development Program (TDP) to research institutes entrusted with developing key industrial technologies and wide applications technologies. Newly developed technology is then transferred to various industries in order to establish new high-tech industries and accelerate industry upgrading. In 1999, the DOIT budget was about NT$15 bn, a quarter of the governmental R&D budget.

For each research field DOIT invites experts from each particular industry, the government and the academic and research institutes, to discuss long-term planning and policy formulation. Based on these policies, the research institutes submit their annual R&D proposals. The evaluation of the proposals is based on many considerations, including potential contribution to industry, government policy, industrial needs, and the capability to undertake and complete the projects as well as the estimated budget.

Starting in 1990, DOIT drew up new promotional plans, which encouraged research institutes to work together with industrial entities. The goal of these co-operative research projects is to match the research institutes' manpower, technologies, information, lab space, equipment and other resources with the industrial partner's specific research needs. Companies get to participate in defining the R&D direction, industrial requirements, and R&D targets. They can also obtain a first-hand understanding of the R&D process, rather than indirectly through technology transfer. Enterprises participating in R&D activities need to contribute part of the R&D expenditures as well as pay matching funds to joint projects.

DOIT has also encouraged both private and public corporations to carry out TDP projects. Both private and state-owned corporations can submit R&D project proposals to DOIT. Once the project has been reviewed and approved, corporations can obtain subsidies for R&D projects, provided they also contribute.

Taiwan has been making serious efforts to develop new technology. One such area singled out for attention is MEMS (Micro Electronic Mechanical Systems). In mid-1996, both the National Science Council and the Ministry of Economic Affairs initiated programs directed specifically at funding MEMS R&D. Prior to that, there had been scattered MEMS research projects. This new funding effort brought them together and provided a more coherent direction. While, Taiwan's level of MEMS technology is currently about ten years behind the state-of-the-art, the government has realised that MEMS will be an enabling technology for many high-tech products in the future.

The experience of Taiwan clearly illustrates the importance of developing a vibrant cluster of Small & Medium Enterprises. Another important lesson is the need for governments to build flexible markets which facilitate easy entry and exit of firms. Yet, another message is the need to move up the value chain consistently by upgrading technological and marketing capabilities.

The author is Dean, ITUC School of Management, an ICFAI affiliate.

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